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FINAL FEASIBILITY REPORT AND ENVIRONMENTAL ASSESSMENT: MARSH LAKE

COMMUNICATION

FROM

THE ASSISTANT SECRETARY, ARMY, CIVIL WORKS, THE DEPARTMENT OF DEFENSE

TRANSMITTING

THE FEASIBILITY REPORT ON THE MARSH LAKE PROJECT

AUGUST 7, 2012.—Referred to the Committee on Transportation and Infrastructure and ordered to be printed

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DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
CIVIL WORKS
108 ARMY PENTAGON
WASHINGTON DC 20310-0108

APR 25 2012

Honorable John Boehner
Speaker of the House
of Representatives
U.S. Capitol Building, Room H-232
Washington, D.C. 20515-0001

Dear Mr. Speaker:

In response to a resolution of the Committee on Public Works of the U.S. House of Representatives adopted May 10, 1962, the Secretary of the Army recommends authorization of the Minnesota River, Marsh Lake Ecosystem Restoration project. The proposal is described in the report of the Chief of Engineers, dated December 30, 2011, which includes other pertinent reports and comments. The views of the State of Minnesota, the Department of the Interior and the Environmental Protection Agency are set forth in the enclosed communications.

The recommended plan would restore aquatic ecosystem structure and function to Marsh Lake and surrounding resources in the upper portion of the Corps of Engineers Lac qui Parle reservoir project. The recommended plan consists of ecosystem restoration features including returning the Pomme de Terre River to its historic channel, modifying the Marsh Lake Dam for fish passage, construction of a water control structure at the Marsh Lake Dam, installation of gated culverts at Louisburg Grade Road, and the breaching of a dike at an abandoned fish pond adjacent to the Marsh Lake Dam. The plan also contains recreation features including shoreline fishing access structures, interpretive signage, a canoe landing, benches, picnic tables, trash receptacles, toilets and parking lot improvements. The project requires mitigation to offset adverse impacts to cultural resources at the site through photographic documentation of the existing site conditions prior to construction. The recommended plan is the National Ecosystem Restoration Plan.

Based on an October 2011 price level, the estimated project first cost is $9,967,000, including $504,000 in recreation features. In accordance with the cost sharing provisions of Section 103(c) of the Water Resources Development Act of 1986, as amended, ecosystem restoration features are cost shared at 65 percent Federal and 35 percent non-Federal and recreation features are cost shared at 50 percent Federal and 50 percent non-Federal. Thus, the Federal share of the project first cost is estimated to be $6,403,000 and the non-Federal share is estimated at $3,564,000. The lands, easements, rights-of-way, relocations, and excavated material disposal areas would be made available to the project at no cost as they are Federally owned. The Minnesota Department of Natural Resources is the non-Federal cost sharing sponsor and would be responsible for the operation, maintenance, repair, replacement, and rehabilitation of the project after construction, a cost currently estimated at $35,000 per year.

Implementation of the project would improve habitat for migratory waterfowl and breeding grounds for the largest white pelican population in North America. The reduction of the suspended sediments and the improved water clarity in the waters of Marsh Lake would benefit a wide range of fish and wildlife species. Providing connectivity between Marsh Lake and Lac qui Parle through the construction of a rock ramp for fish passage would increase fish habitat.

The Office of Management and Budget (OMB) advises that there is no objection to the submission of the report to Congress and concludes that the report recommendation is consistent with the policy and programs of the President. A copy of OMB's letter, dated April 23, 2012, is enclosed. I am providing a copy of my letter to the House Committee on Appropriations Subcommittee on Energy and Water Development, and the House Committee on Transportation and Infrastructure Subcommittee on Water Resources and Environment. I am providing an identical letter to the President of the Senate.

Very truly yours,

Jo-Ellen Darcy

Jo-Ellen Darcy
Assistant Secretary of the Army
(Civil Works)

Enclosures

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

April 23, 2012

The Honorable Jo-Ellen Darcy
Assistant Secretary of the Army (Civil Works)
108 Army Pentagon
Washington, D.C. 20310-0108

Dear Ms. Darcy:

As required by Executive Order 12322, the Office and Management and Budget have completed its review of an Army Corps of Engineers' proposal for ecosystem restoration project for the Minnesota River, Marsh Lake Minnesota. Based on our review, we conclude that your recommendation for authorization of construction of this project is consistent with the policy and programs of the President.

The Office of Management and Budget does not object to your submitting the report to Congress for authorization. When you do so, please advise the Congress that should the Congress authorize the project for construction, the project would need to compete with other proposed investments in future budgets.

Sincerely,

Richard A. Mertens
Deputy Associate Director
Energy, Science and Water Division

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20314-1000

CECW-MVD (1105-2-10a) DEC 30 2011

SUBJECT: Minnesota River, Marsh Lake Ecosystem Restoration Project, Minnesota

THE SECRETARY OF THE ARMY

1. I submit for transmission to Congress my report on ecosystem restoration along the Minnesota River at Marsh Lake, a part of the Lac qui Parle Reservoir, west of Appleton, Minnesota. It is accompanied by the report of the district and division engineers. These reports were completed under authorities granted by a May 10, 1962, resolution of the Committee on Public Works of the U.S. House of Representatives. This resolution requested the review of "the report of the Chief of Engineers on the Minnesota River, Minnesota, published as House Document 230, 74th Congress, First Session and other pertinent reports, with a view to determining the advisability of further improvements in the Minnesota River Basin for navigation, flood control, recreation, low flow augmentation, and other related water and land resources." Preconstruction engineering and design activities for the Marsh Lake Ecosystem Restoration Project will continue under the authority provided by the resolution above.

2. The Marsh Lake ecosystem function and connectivity has degraded over time primarily as a result of artificial changes to the hydrologic conditions at the site. The ecosystem significance of the area is demonstrated on the national, regional and local level. Marsh Lake provides critical stop-over refuge for migratory waterfowl moving through the Mississippi River flyway as well as breeding grounds for the largest white pelican population in North America. Many other fish and bird species are also dependent on the resource for life requisites including both migrating and nesting bald eagles. Ecosystem values provided by Marsh Lake have increased in importance over time as 90 percent of the wetland areas within the watershed have been drained.

3. The reporting officers recommend authorization of a plan to restore aquatic ecosystem structure and function as well as implementation of ancillary recreation features to Marsh Lake and surrounding resources in the upper portion of the Lac qui Parle reservoir. The recommended plan consists of ecosystem restoration features including returning the Pomme de Terre River to its historic channel, modifying the Marsh Lake Dam for fish passage, construction of a drawdown water control structure at the Marsh Lake Dam, installation of gated culverts at Louisburg Grade Road, and the breaching of a dike at an abandoned fish pond adjacent to the Marsh Lake Dam. The plan also contains recreation features including shoreline fishing access structures, interpretive signage, a canoe landing, benches, picnic tables, trash receptacles, toilets, and parking lot improvements. The project requires mitigation to offset adverse impacts to Marsh Lake Dam through photographic documentation of the existing site conditions prior to construction since Marsh Lake Dam was determined individually eligible to the National Register of Historic Places. The recommended plan is the National Ecosystem Restoration Plan. Implementation of the recommended plan will have a substantial beneficial impact on fish and

wildlife species in the area. While the project will not directly affect federally-listed endangered or threatened species, the reduction of the suspended sediments in the waters of Marsh Lake and improved water clarity will benefit a wide-range of fish and wildlife species including species of concern such as the bald eagle, that are known to use the Marsh Lake site.

4. Based on an October 2011 price level, the estimated project first cost is $9,967,000. The project first cost includes approximately $9,463,000 for ecosystem restoration and approximately $504,000 for recreation. In accordance with the cost sharing provisions of Section 103(c) of the Water Resources Development Act of 1986 (WRDA 1986), as amended (33 U.S.C. 2213(c)), ecosystem restoration features are cost-shared at a rate of 65 percent Federal and 35 percent non-Federal; and recreation features are cost-shared at a rate of 50 percent Federal and 50 percent non-Federal. Thus, the Federal share of the project first costs is estimated to be $6,403,000 and the non-Federal share is estimated at $3,564,000, which equate to 64 percent Federal and 36 percent non-Federal. The costs of lands, easements, rights-of-way, relocations, and excavated material disposal areas is estimated to have no cost, given the existing Federal ownership over the project area. The State of Minnesota, Department of Natural Resources is the non-Federal cost share sponsor for the recommended plan. The State of Minnesota, Department of Natural Resources would be responsible for the operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) of the project after construction, a cost currently estimated at $35,000 per year.

5. Based on a 4.0-percent discount rate and a 50-year period of analysis, the total equivalent annual costs of the project, including OMRR&R, are estimated to be $490,000.

a. The equivalent average annual costs of ecosystem restoration features are estimated to be $464,000, including OMRR&R. The cost of the recommended aquatic ecosystem restoration features is justified by the restoration of about 8,400 average annual habitat units which includes restoration of approximately two linear miles of historic riverine habitat.

b. The equivalent average annual costs of recreation features are estimated to be $26,000, including OMRR&R. The annual benefits of the proposed recreation features are estimated at $230,000. The benefit-to-cost ratio for recreation is 8.9 to 1.

6. The recommended plan was developed in coordination and consultation with various Federal, State, and local agencies using a systems approach in formulating ecosystem restoration solutions and in evaluating the impacts and benefits of those solutions. Plan formulation evaluated a wide range of non-structural and structural alternatives under Corps policy and guidelines as well as consideration of a variety of economic, social and environmental goals. The recommended plan delivers a holistic, comprehensive approach to solve water resources challenges in a sustainable manner. The resulting recommended plan has received broad public support.

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7. In accordance with EC 1165-2-209, all technical, engineering and scientific work underwent an open, dynamic and vigorous review process to ensure technical quality. This included Agency Technical Review (ATR) and a Corps Headquarters policy and legal review. All concerns of the ATR have been addressed and incorporated into the final report. An exclusion from the Independent External Peer Review (IEPR) was granted by the Director of Civil Works.

8. I concur in the findings, conclusions, and recommendations of the reporting officers. Accordingly, I recommend that the plan to restore the ecosystem of Marsh Lake be authorized in accordance with the reporting officers' recommended plan at an estimated project first cost of $9,967,000 with such modifications as in the discretion of the Chief of Engineers may be advisable. My recommendation is subject to cost sharing, financing, and other applicable requirements of Federal and State laws and policies, including Section 103 of WRDA 1986, as amended by Section 202 of WRDA 1996, and WRDA 1986, as amended by Section 210 of WRDA 1996. Accordingly, the non-Federal sponsor must agree with the following requirements prior to project implementation.

a. Provide 35 percent of total ecosystem restoration costs as further specified below:

1. Provide the non-Federal share of design costs allocated by the Government to ecosystem restoration in accordance with the terms of a design agreement entered into prior to commencement of design work for the ecosystem restoration features;

2. Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct all improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material all as determined by the Government to be required or to be necessary for the construction, operation, and maintenance of the project;

3. Provide, during the design and implementation phase, any funds necessary to make its total contribution equal to 35 percent of total project costs;

b. Provide 50 percent of total recreation costs as further specified below:

1. Provide the non-Federal share of design costs allocated by the Government to recreation in accordance with the terms of a design agreement entered into prior to commencement of design work for the recreation features;

2. Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct all improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material

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all as determined by the Government to be required or to be necessary for the construction, operation, and maintenance of the recreation features;

3. Provide, during construction, any additional funds necessary to make its total contribution for recreation equal to 50 percent of total recreation costs;

4. Provide, during construction, 100 percent of the total recreation costs that exceed an amount equal to 10 percent of the Federal share of total ecosystem restoration costs;

c. Provide, during the design and implementation phase, 100 percent of all costs of planning, design, and construction for the project that exceed the Federal share of the total project costs;

d. Shall not use funds from other Federal programs, including any non-Federal contribution required as a matching share therefore, to meet any of the non-Federal obligations for the project unless the Federal agency providing the Federal portion of such funds verifies in writing that expenditure of such funds for such purpose is authorized by Federal law;

e. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on project lands, easements, and rights-of-way or the addition of facilities which might reduce the outputs produced by the project, hinder operation and maintenance of the project, or interfere with the project's proper function;

f. Shall not use the project or lands, easements, and rights-of-way required for the project as a wetlands bank or mitigation credit for any other project;

g. Comply with all applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended (42 U.S.C. 4601-4655), and the Uniform Regulations contained in 49 Code of Federal Regulations (CFR) Part 24, in acquiring lands, easements, and rights-of-way required for construction, operation, and maintenance of the project, including those necessary for relocations, the borrowing of materials, or the disposal of dredged or excavated material; and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;

h. For so long as the project remains authorized, operate, maintain, repair, rehabilitate, and replace the project, or functional portions of the project, including any mitigation features, at no cost to the Federal Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government;

i. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the project for the purpose of completing, inspecting, operating, maintaining, repairing, rehabilitating, or replacing the project;

j. Hold and save the United States free from all damages arising from the design, construction, operation, maintenance, repair, rehabilitation, and replacement of the project and any betterments, except for damages due to the fault or negligence of the United States or its contractors;

k. Keep and maintain books, records, documents, or other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, or other evidence are required, to the extent and in such detail as will properly reflect total project costs, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 CFR Section 33.20;

l. Comply with all applicable Federal and State laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d) and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army"; and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141- 3148 and 40 U.S.C. 3701 – 3708 (revising, codifying and enacting without substantial change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a *et seq.*), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 *et seq.*), and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c *et seq.*);

m. Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 96-510, as amended (42 U.S.C. 9601-9675), that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for construction, operation, and maintenance of the project. However, for lands that the Federal Government determines to be subject to the navigation servitude, only the Federal Government shall perform such investigations unless the Federal Government provides the non-Federal sponsor with prior specific written direction, in which case the non-Federal sponsor shall perform such investigations in accordance with such written direction;

n. Assume, as between the Federal Government and the non-Federal sponsor, complete financial responsibility for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for construction, operation, and maintenance of the project;

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o. Agree, as between the Federal Government and the non-Federal sponsor, that the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, repair, rehabilitate, and replace the project in a manner that will not cause liability to arise under CERCLA;

p. Provide, during the design and implementation phase, 35 percent of all costs that exceed $50,000 for data recovery activities associated with historic preservation for the project; and

q. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended (42 U.S.C. 1962d-5b), and Section 103(j) of the Water Resources Development Act of 1986, Public Law 99-662, as amended (33 U.S.C. 2213(j)), which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until each non-Federal interest has entered into a written agreement to furnish its required cooperation for the project or separable element.

9. The recommendation contained herein reflects the information available at this time and current departmental policies governing formulation of individual projects. It does not reflect program and budgeting priorities inherent in the formulation of a national civil works construction program or the perspective of higher review levels within the executive branch. Consequently, the recommendation may be modified before it is transmitted to the Congress as a proposal for authorization and implementation funding. However, prior to transmittal to Congress, the sponsor, the State, interested Federal agencies, and other parties will be advised of any significant modifications and will be afforded an opportunity to comment further.

Merdith W. B. Temple
MERDITH W. B. TEMPLE
Major General, U.S. Army
Acting Chief of Engineers

Minnesota Department of Natural Resources

500 Lafayette Road
St. Paul, Minnesota 55155-4010

November 14, 2011

Headquarters
U.S. Army Corps of Engineers
CECW-P (SA)
7701 Telegraph Road
Alexandra, VA 22315-3860

RE: Marsh Lake Ecosystem Restoration Project

Dear Theodore A. Brown,

The Minnesota Department of Natural Resources (MNDNR) and the U.S. Army Corps of Engineers have been coordinating and planning for the restoration of the Marsh Lake ecosystem in western Minnesota for more than a decade. The culmination of these efforts, as well as ample public outreach, is the *Feasibility Report and Environmental Assessment* (EA) for the Marsh Lake Ecosystem Restoration Project (Proposed Project) prepared by the U.S. Army Corps of Engineers.

On November 10, 2011 the MNDNR completed its Record of Decision on the Proposed Project to satisfy state environmental review requirements. The MNDNR has made a negative declaration on the need for a state Environmental Impact Statement.

The MNDNR fully supports the analysis and conclusions contained in the EA and the implementation of the project components included in Alternative Plan 4. An improved Marsh Lake ecosystem would be an essential step forward in increasing Minnesota's wildlife and aquatic species populations. The MNDNR looks forward to continued collaboration with your agency in working to implement this important restoration project.

Sincerely,

Steve Colvin, Supervisor
Minnesota Dept. of Natural Resources
500 Lafayette Road, Box 25
St. Paul, MN 55155-4025
(651) 259-5082
steve.colvin@state.mn.us

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

TAKE PRIDE IN AMERICA

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Mr. Theodore A. Brown, P.E.
Chief, Planning and Policy Division
Directorate of Civil Works
Headquarters
U.S. Army Corps of Engineers
CECW-P (SA)
7701 Telegraph Road
Alexandria, VA 22315-3860

RE: Chief of Engineers and the Report of the District Engineer on the Marsh Lake Ecosystem Restoration Project, Minnesota

Dear Mr. Brown:

The U.S. Department of the Interior (Department) has reviewed the U.S. Army Corps of Engineers (Corps), Chief of Engineers Report, and supporting documents on the Marsh Lake Ecosystem Restoration Project in Minnesota.

Our U.S. Fish and Wildlife Service (FWS) previously provided comments to the Corps St. Paul district office under the Fish and Wildlife Coordination Act (FWCA). The Department has no further comments and no objections to the proposed project.

We appreciate the opportunity to provide comments. If you have any questions or need further assistance related to the FWCA, please contact Richard Davis, FWS, at 612-725-3548 (ext. 2214) or email Richard_Davis@fws.gov.

Sincerely,

Willie R. Taylor
Director, Office of Environmental Policy
and Compliance

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

OCT 3 1 2011

REPLY TO THE ATTENTION OF:

E-19J

Theodore A. Brown
Chief, Planning and Policy Division
U.S. Army Corps of Engineers – Headquarters
CECW-P (SA)
7701 Telegraph Road
Alexandria, Virginia 22315

RE: Feasibility Report and (Final) Environmental Assessment for the Marsh Lake Ecosystem Restoration Project / Proposed Report of the USACE Chief of Engineers / Minnesota Department of Natural Resources Environmental Assessment Worksheet: Big Stone, Lac qui Parle, and Swift Counties, Minnesota

Dear Mr. Brown:

The U.S. Environmental Protection Agency has received U.S. Army Corps of Engineers (USACE) correspondence dated October 11, 2011, requesting EPA's review of and comments on the (Final) Feasibility Report and Environmental Assessment (hereby referred to as the Final EA) and the proposed report of the Chief of Engineers for the proposed Marsh Lake Ecosystem Restoration Project. The overall goal of the Marsh Lake Ecosystem Restoration Project is a "return of the Marsh Lake area ecosystem to a less degraded and more natural and functional condition."

Objectives proposed to meet this goal include reducing sediment loading to Marsh Lake, restoring natural fluctuations to the hydrologic regime of Marsh Lake, restoring the Pomme de Terre River to its original course and floodplain, reducing sediment resuspension within Marsh Lake, increasing native plant cover and diversity within Marsh Lake, restoring aquatic habitat connectivity between Marsh Lake, the Pomme de Terre River, and Lac Qui Parle, reduction of non-native fish within Marsh Lake, and increasing diversity and abundance of native fish within Marsh Lake and the Pomme de Terre River.

EPA has reviewed the Final EA for the aforementioned project. This letter provides our comments on the Final EA, pursuant to the National Environmental Policy Act (NEPA), the Council on Environmental Quality's NEPA Implementing Regulations (40 CFR 1500-1508), and Section 309 of the Clean Air Act.

The Final EA presents proposed actions by USACE to restore Marsh Lake to a more natural and functional condition. USACE's preferred alternative is referred to in the document as "Alternative Plan 4", which maximizes benefits in relation to cost and meets planning objectives. Specifically, USACE's preferred alternative proposes the following restoration measures:

1. **Restoration of the Pomme de Terre River into its existing natural channel.** During construction of the Marsh Lake Dam, the Pomme de Terre River was rerouted in a channelized fashion between 1936 and 1939 to outlet into Marsh Lake. In order to reconnect the river to its natural channel, two earthen cut-off dikes are proposed to be constructed to force the river flow back to the natural channel. Approximately 11,500' of natural channel will receive restored flow. This measure will reduce sediment loading to Marsh Lake as the river will no longer outlet into Marsh Lake directly upstream of the Marsh Lake Dam; the river will flow east of, and connect to, the outlet channel of the Marsh Lake Dam (the Minnesota River). Restoration will also remove fish habitat fragmentation by allowing native fish from Lac qui Parle to access the high quality spawning habitat of the Pomme De Terre River, and will also allow the river to have access to its natural floodplain. A 450' long vehicular bridge over the restored river channel is proposed to be constructed to maintain access to the Marsh Lake Dam.

2. **Breaching of the dike at the abandoned fish pond located south and downstream of the Marsh Lake Dam.** Dike breaching will allow connectivity between the pond and Lac qui Parle/Minnesota River, will allow fish access to the pond area, and will provide shorebird habitat during low water levels.

3. **Construction of water control structures (stop log structures) at the existing Marsh Lake Dam to allow drawdowns.** Modifications as proposed to the Marsh Lake Dam will allow for active water level management within the lake. Water level management is proposed in spring/summer conditions as needed to allow for controlled drawdowns to encourage emergent aquatic plants to germinate and establish. Winter drawdowns are also proposed to reduce water levels and dissolved oxygen within the lake to impose hypoxia stress and winter kill on invasive carp, which currently dominate the lake.

4. **Installation of gated culverts at three existing culvert locations along Louisburg Grade Road.** A total of seven existing deteriorating 60" diameter culvert pipes at three locations are proposed to be replaced with concrete box culverts with stop log water control structures. New culverts with stop log structures are proposed to allow management of water levels upstream of the culverts in the upper part of Marsh Lake. Higher water levels can be managed in upper Marsh Lake to allow for spawning of desirable northern pike and improve survivability of young fish in early spring. Removal or lowering of the stop log structures later in the season would allow access between upper Marsh Lake and Marsh Lake to promote a native fishery within Marsh Lake.

5. **Construction of a fishway at the existing Marsh Lake Dam.** The rock ramp/riffle fishway as proposed will allow year-round fish passage between Marsh Lake, Lac Qui Parle, and the Pomme de Terre River.

Overall, the Final EA adequately identifies and assesses potential impacts associated with the Preferred Alternative. Minor impacts to (placement of fill into) existing wetlands and waters are proposed in order to implement the preferred alternative measures. Specifically, restoration of the Pomme de Terre River will require construction of two earthen cut-off dikes (Diversion Dikes A & B) to redirect the river flow back to its existing natural channel. A third area of fill (road raising along 225th Ave. SW) is proposed to prevent movement of water between Marsh Lake and the Pomme de Terre River through a low area on the east side of Marsh Lake.

The two Diversion Dikes are to be installed within the channelized portion of the Pomme de Terre River and its floodplain; in addition to fill within the current river channel, it appears likely that the diversion dikes will also be built in adjacent floodplain wetland areas. The placement of fill material into wetlands and/or the Pomme de Terre River waterways will require coordination and permitting from several of Minnesota's state regulatory agencies. From information provided with the document and appendices, it appears that permitting coordination and dialogue has begun with appropriate divisions of both the Minnesota Pollution Control Agency and the Minnesota Department of Natural Resources. Additional coordination with local government units may be required under the Minnesota Wetland Conservation Act. EPA expects that if wetland mitigation is required, it will meet mitigation requirements of the regulatory agencies' standards and ratios.

Additional fill to wetlands and waters is associated with both the new vehicular bridge to be installed over the Pomme de Terre River and with four proposed rock grade control structures to be installed in the original channel of the Pomme de Terre River. During installation of these grade control structures, care should be taken to select access points and staging areas that minimize damage to adjacent wetlands and floodplain forests, and to minimize in-stream and downstream sedimentation during installation.

Modification of the existing Marsh Lake Dam for installation of water control structures and a fishway will also require installation of large boulders and rocks as well as riprap within the outlet channel of Marsh Lake at the dam. Additional proposed recreation facilities such as fishing platforms to be installed along Marsh Lake will also require fill to the lake.

Replacement of the existing culverts along Louisburg Grade Road will require installation of new concrete box culverts and riprap armoring upstream and downstream of the new culverts. If water velocities and engineering allow, EPA recommends that armor rock be removed during final design. Additionally, multiple cell concrete box culverts (EPA assumes four-sided culverts) are proposed for installation. As the purpose of the new culverts and associated stop log structures is to manage water levels in upper Marsh Lake to promote a healthy, native fishery within Marsh Lake, EPA recommends that culverts be designed to allow fish and other aquatic organism passage and to ensure continuity of the aquatic habitat (by not restricting or altering water depth, flow, or velocity). As the purpose of the new culverts is to allow for installation of stop-log structures on the culvert, EPA assumes that bottomless culverts cannot be used. If four-sided box culverts must be used, they should be embedded a minimum of two feet into the bottom of the lake.

EPA recommends you review design considerations developed by the River and Stream Continuity Partnership at:
http://www.streamcontinuity.org/pdf_files/MA%20Crossing%20Stds%203-1-11.pdf.

Construction plans (Appendix N) currently label fill materials to be used as "random fill." EPA expects that this "random fill" will be clean, inert material. As construction plans are finalized, EPA recommends that notations of "random fill" be modified to specify fill type(s).

To further minimize impacts to wetlands and sensitive aquatic habitats, EPA recommends the following measures be implemented during construction:

- Winter construction, if/when feasible;
- Minimize widths of temporary access roads/paths;
- Use removable materials for construction of temporary access roads/paths (e.g. timber/swamp mats) in lieu of "fill" materials such as stone, riprap, or wood chips;
- Use timber/swamp mats to distribute the weight of construction equipment in order to minimize soil rutting and compaction;
- Use vehicles and construction equipment with wide tires or rubberized tracks, or low ground-pressure equipment, to further minimize wetland impacts during construction;
- Use long-reach excavators, where appropriate, to avoid driving, traversing, or staging in wetland or floodplain areas;
- Use cofferdams and dam/pump arounds to isolate work areas from active flow;

EPA also hereby reiterates comments from our June 16, 2011, correspondence in which we noted that the lower channelized portion of the Pomme de Terre River supports a diverse mussel community, including two state-listed mussel species (the elktoe and black sandshell). EPA supports the Monitoring and Adaptive Management plan to be implemented by the Minnesota DNR (MnDNR) to monitor and evaluate the response of native mussels in the restored portion of the Pomme de Terre River. EPA encourages MnDNR to harvest mussels from the portion of channel to be abandoned and to relocate them into the restored portion of river channel.

Additionally, prior to any tree removal required by project implementation, bald eagle nesting trees should be inspected and verification of the location and status of the nest should be completed prior to completing any construction within 660' of the nest site. Construction timelines should also be developed to minimize impacts to colonial water-nesting bird species, particularly during prime nesting times.

Except for temporary localized water, sediment/erosion control, and noise quality impacts associated with construction, the Final EA identifies that no significant permanent environmental impacts are anticipated to result as a result of implementation of the proposed Preferred Alternative. EPA commends the level of detail provided in your Final EA, particularly in the Feasibility Report Appendices.

Thank you for the opportunity to review and comment upon the Final Feasibility Report and Environmental Assessment. We are available to discuss our comments with you in further detail if requested. **Please send us the signed Finding of No Significant Impact (FONSI) when it becomes available.** If you have any questions about this letter, please contact Ms. Liz Pelloso, PWS, of my staff at 312-886-7425 or via email at pelloso.elizabeth@epa.gov.

Sincerely,

Kenneth A. Westlake, Chief
NEPA Implementation Section
Office of Enforcement and Compliance Assurance

cc: Richard Davis, US Fish and Wildlife Service-Twin Cities Field Office
Michael Wyatt, USACE-St. Paul District
Kevin Molloy, Minnesota Pollution Control Agency
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FINAL REPORT

US Army Corps of Engineers
St. Paul District
Mississippi Valley Division

Feasibility Report and Environmental Assessment

Marsh Lake Ecosystem Restoration Project

Minnesota River

Big Stone, Lac qui Parle, and Swift Counties, Minnesota

Photo by Ron Bolduan

Completed in conjunction with the Minnesota Department of Natural Resources

November 2011

ERRATA

As of October1, 2011 (Federal Fiscal Year 2012), the Federal interest and amortization rate changed from 4.125% to 4.0%. This change in rate primarily affects annualized project costs and benefits included in the report. As a result, this errata sheet documents the change in value for the following items within the report:

Summary (page 5):

Breakout of Total Project Costs and Benefits Marsh Lake Ecosystem Restoration - Tentatively Selected Plan	
	Ecosystem Restoration
Total Project First Costs	$ 9,967,000
Interest During Construction (4.0%)	$ 207,000
Present Worth of Investment	**$ 10,174,000**
Annualized Total Project Costs	$ 490,000
Annual Operations and Maintenance Costs	$ 35,000
Total Annual Benefits (Habitat Units)	8390
Total Annual Benefits (Recreation)	$ 230,000

Page 5: Average annual costs of the Recommended Plan should be changed from $474,000 to $464,000; economic benefit should be changed from $225,000 to $230,000; the benefit cost-ratio should be changed from 8.6 to 8.9; and the annualized cost should be changed from $500,000 to $490,000.

Table 4-3. Costs of alternative measures (page 138):

Alternative Measure Number	Alternative Measures	Net Benefit (AAHU)	First Costs of Construction	O&M Cost	Planning, Engineering & Design (PED)	Construction Management (CM)	Total First Project Costs	Average Annual Costs
1	No Action	0	$ -	$ -	$ -	$ -	$ -	$ -
2	Restore Pomme de Terre River to its former channel	6567	$ 3,448,212	$ 11,508	$ 387,945	$ 193,973	$ 4,030,130	$ 199,438
3	Modify Marsh Lake Dam to attain target water levels, construct fishway	483	$ 1,399,695	$ 7,245	$ 154,433	$ 77,216	$ 1,631,344	$ 83,682
4	Construct drawdown water control structure	725	$ 2,594,217	$ 13,503	$ 278,993	$ 139,496	$ 3,012,706	$ 154,644
5	Install gated culverts in Louisburg Grade Road	610	$ 448,902	$ 800	$ 52,815	$ 26,408	$ 528,125	$ 25,555
6	Breach dike at abandoned fish pond	5	$ 6,426	$ 50	$ 870	$ 435	$ 7,731	$ 413
7	Construct islands in Marsh Lake	239	$ 4,006,254	$ 20,376	$ 448,875	$ 224,438	$ 4,679,567	$ 239,658

Table 5-1 Alternative plans with average annual benefits and average annual costs (page 143):

Average annual costs and the subsequent average annual costs per average annual habitat unit would decrease proportionally with the values reflected above in Table 4-3. This table is derived from analysis from IWR-Plan which was not rerun for the purposes of this errata sheet given that since the decrease in costs is proportional across all alternative measures, the overall analysis and resulting plan selection does not change. Revised average annual costs of the final array of alternative plans, however, is included below in Table 6-2.

Table 5-2. Costs and benefits (Average Annual Habitat Units) of alternative measures (page 144):

Alternative Measure Number	Alternative Measures	Net Benefit (AAHU)	Total First Project Costs	Average Annual Costs	Annualized Cost (per AAHU)
1	No Action	0	$ -	$ -	$ -
2	Restore Pomme de Terre River to its former channel	6567	$ 4,030,130	$ 199,438	$ 30
3	Modify Marsh Lake Dam to attain target water levels, construct fishway	483	$ 1,631,344	$ 83,682	$ 173
4	Construct drawdown water control structure	725	$ 3,012,706	$ 154,644	$ 213
5	Install gated culverts in Louisburg Grade Road	610	$ 528,125	$ 25,555	$ 42
6	Breach dike at abandoned fish pond	5	$ 7,731	$ 413	$ 83
7	Construct islands in Marsh Lake	239	$ 4,679,567	$ 239,658	$ 1,003
Interest and Amoritization on Factor for 4% interest (0.04) over the 50 year payment period.					

Table 6-2. Incremental costs of Best Buy/Alternative Plans (page 162)*

No.	Restore Pomme de Terre	Modify Marsh Lake Dam	Drawdown Structure	Louisburg Grade Road Gated Culverts	Modify Abandoned Fish Pond	Construct Islands in Marsh Lake	Average Annual Habitat Units (AAHU)	Average Annual Costs	Average Costs per AAHU	Incremental Increase in Cost per AAHU
1							0	$ -	$ -	$ -
25	X						6567	$ 199,438	$ 30.37	$ 30.37
26	X				X		6572	$ 199,851	$ 30.41	$ 82.54
42	X		X	X	X		7907	$ 380,049	$ 48.06	$ 134.98
46	X	X	X	X	X		8390	$ 463,731	$ 55.27	$ 173.25
48	X	X	X	X	X	X	8508	$ 703,389	$ 82.67	$ 2,031.00

*Note that subsequent references to incremental costs in Section 6.3 should reflect the values noted in Table 6-2, above.

Section 7. RECOMMENDED PLAN (pages 181, 183)

Page 181: Consistent with table 6-2 above, the costs of Alternative Plan 4 should be changed from "$56.41 per AAHU" to "55.27 per AAHU" and the incremental cost increase of Alternative Plan 5 should be changed from $2072.33 to $2031.00.

Page 183: The average annual costs of the ecosystem restoration plan should be changed from $474,000 to $464,000.

Table 7-8. Project recreation average annual benefit (page 198)

Picnicking	$	14,700
Wildlife Viewing	$	86,300
Fishing	$	91,400
Canoe/kayak	$	37,600
TOTAL ANNUAL AVG BENEFITS	**$**	**230,000**

Page 199: The amortization rate should be changed from 4-1/8 to 4 percent. Note that because of the use of rounded numbers, the average annual costs of the recreation features remain the same. The net annual benefits should be

changed from $199,000 to $204,000 and the benefit-cost ratio should be changed from 8.6 to 8.9.

Table 7-9. Economic summary of the recommended plan (page 200):

Breakout of Total Project Costs and Benefits	
Marsh Lake Ecosystem Restoration - Tentatively Selected Plan	
	Ecosystem Restoration
Total Project First Costs	$ 9,967,000
Interest During Construction (4.0%)	$ 207,000
Present Worth of Investment	**$ 10,174,000**
Annualized Total Project Costs	$ 490,000
Annual Operations and Maintenance Costs	$ 35,000
Total Annual Benefits (Habitat Units)	8390
Total Annual Benefits (Recreation)	$ 230,000

Contribution to NED Account (page 203): change average annual benefits from $225,000 to $230,000; change contribution to National Economic Development Account from $199,000 to $204,000.

Section 11. Recommendation (page 212): change benefit-cost ratio from 8.6 to 8.9.

Summary

Introduction

This report was prepared in response to the study authorization contained in a Resolution of the Committee on Public Works of the U.S. House of Representatives, May 10, 1962. The resolution reads as follows:

"Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors be, and is hereby, requested to review the report of the Chief of Engineers on the Minnesota River, Minnesota, published as House Document 230, 74th Congress, First Session and other pertinent reports, with a view to determining the advisability of further improvements in the Minnesota River Basin for navigation, flood control, recreation, low flow augmentation, and other related water and land resources."

In response to the study authority the reconnaissance phase of the study was completed in December 2004 (USACE 2004) and approved in January 2005. The reconnaissance study resulted in the finding of Federal interest in and potential solutions to several existing water resources problems that warrant feasibility studies, including ecosystem restoration at Marsh Lake.

The Minnesota Department of Natural Resources (DNR) as the non-Federal sponsor, and the U.S. Army Corps of Engineers, St. Paul District (Corps) initiated the feasibility phase of the study on February 2, 2006. The feasibility phase study cost was shared equally between the Corps and the sponsor.

This summary is intended to describe the major factors which were considered in the investigation and influenced the decisions and recommendations documented in this report.

Planning Process and NEPA

Starting in November 2000 through 2002, the DNR conducted a planning process with interagency coordination and public participation to identify ways to restore the Marsh Lake ecosystem.

In collaboration with the DNR and making use of the information generated from the DNR's earlier planning for Marsh Lake, the project delivery team identified the problems and opportunities, set project objectives, identified and evaluated a number of alternative measures for Marsh Lake ecosystem restoration, formulated alternative plans, assessed the costs, benefits, environmental and social impacts of the alternative plans, coordinated with agencies and the public, recommended a plan and documented the planning process in the integrated Feasibility Report and Environmental Assessment (FR/EA).

This FR/EA has been prepared to meet Corps of Engineers planning guidance and National Environmental Policy Act (NEPA) requirements. Following agency and public review, a final FR/EA will be prepared. The St. Paul District Commander will consider signing a Finding of No Significant Impact for the Marsh Lake Ecosystem Restoration Project to conclude the National Environmental Policy Act (NEPA) process.

This planning process has been subject to Value Engineering Review, Agency Technical Review, review by interested agencies and the public, and review by the Corps of Engineers Mississippi Valley Division and by Corps Headquarters.

Major Conclusions and Findings

Planning Objectives

The investigation of the problems and opportunities led to the establishment of the following planning goals and objectives for ecosystem restoration in the Marsh Lake study area.

Goal

A return of the Marsh Lake area ecosystem to a less degraded and more natural and functional condition

Objectives

1. Reduced sediment loading to Marsh Lake over the 50-year period of analysis

2. Restored natural fluctuations to the hydrologic regime of Marsh Lake over the 50-year period of analysis

3. Restored geomorphic and floodplain processes to the Pomme de Terre River over the 50-year period of analysis

4. Reduced sediment resuspension within Marsh Lake over the 50-year period of analysis

5. Increased extent, diversity and abundance of emergent and submersed aquatic plants within Marsh Lake over the 50-year period of analysis

6. Increased availability of waterfowl habitat within Marsh Lake over the 50-year period of analysis

7. Restored aquatic habitat connectivity between Marsh Lake, the Pomme de Terre River and Lac Qui Parle over the 50-year period of analysis

8. Reduced abundance of aquatic invasive fish species within Marsh Lake over the 50-year period of analysis

9. Increased diversity and abundance of native fish within Marsh Lake and the Pomme de Terre River over the 50-year period of analysis

Alternatives

A wide range of alternative measures were identified to address the planning objectives. Alternative plans were formulated. Alternative measures evaluated as a part of this study are as follows:

- Modifications to the Marsh Lake Dam to enable passive and active water level management.
- Provide for fish passage between Lac qui Parle Lake and Marsh Lake and the Pomme de Terre River. Restore the Pomme de Terre River to its former channel near its confluence with the Minnesota River. Construct a bridge over the Pomme de Terre River to maintain access to the Marsh Lake Dam.
- Construct rock wave-break islands in Marsh Lake to reduce wind fetch, wave action, and sediment resuspension to restore aquatic vegetation.
- Reconnect the abandoned fish rearing pond next to the Marsh Lake Dam with the upper end of Lac qui Parle.
- Install gated culverts in the Louisburg Grade Road to enable water level management in upper Marsh Lake.
- Modify the Reservoir Regulation Plan for the Lac qui Parle Flood Control Project to include growing season drawdowns of Marsh Lake as needed to restore aquatic vegetation in years when river discharge allows.
- Construct recreational and educational features including a trail bridge over Marsh Lake Dam to connect with the Minnesota State Trail, fishing access on Marsh Lake, canoe access on the Pomme de Terre River, and an improved recreation area at Marsh Lake Dam.
- Monitor the ecological effectiveness of the Marsh Lake ecosystem restoration features to provide information for future adaptive ecosystem management.

Local Support

The non-Federal sponsor, the Minnesota Department of Natural Resources, has expressed the desire for implementing ecosystem restoration and sponsoring project construction in accordance with the items of local cooperation that are set forth in this report. The financial analysis indicates that the non-Federal sponsor is financially capable of participating in the project.

Recommended Plan

The Recommended Plan recommended for implementation is Alternative Plan 4 which consists of the following:

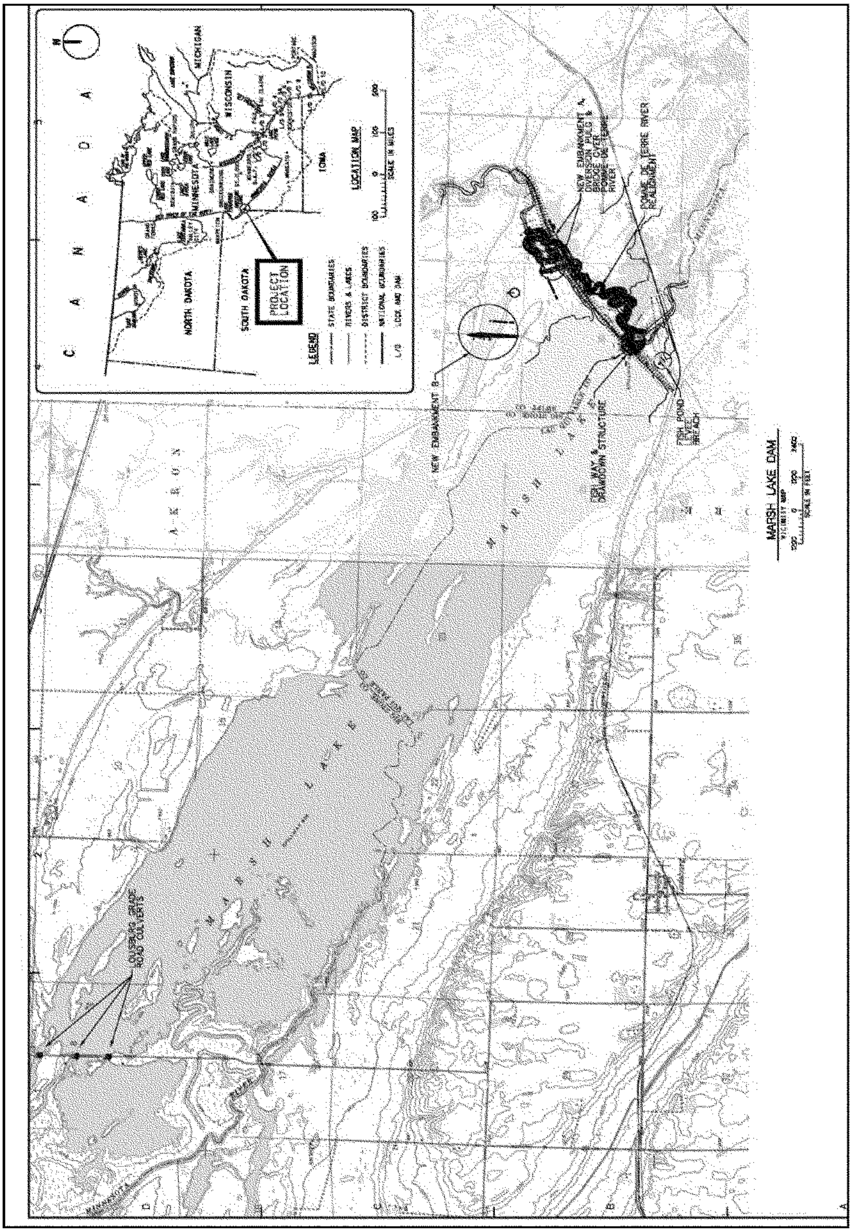
- Restore the Pomme de Terre River to its historic channel
- Breach dike at abandoned fish pond
- Construct drawdown structure
- Construct Louisburg Grade Road gated culverts
- Modify the Marsh Lake Dam, construct fishway

Through the planning process outlined in this report, it was determined that Alternative Plan 4, consisting of the measures noted above, provided the greatest increase in benefits, addressing each planning objective, at the least cost. The Recommended Plan will provide an increase of approximately 8400 Habitat Units at an average annual cost of $474,000. In addition, a number of recreation features will be constructed (highlighted in Section 7.2) that will provide approximately $225,000 of economic benefit at an 8.6 benefit-cost ratio with an average annual cost of $26,000. The total project costs of the ecosystem and recreation features equals $9,967,000 with an annualized cost of $500,000. The costs and benefits of the Recommended Plan are summarized below:

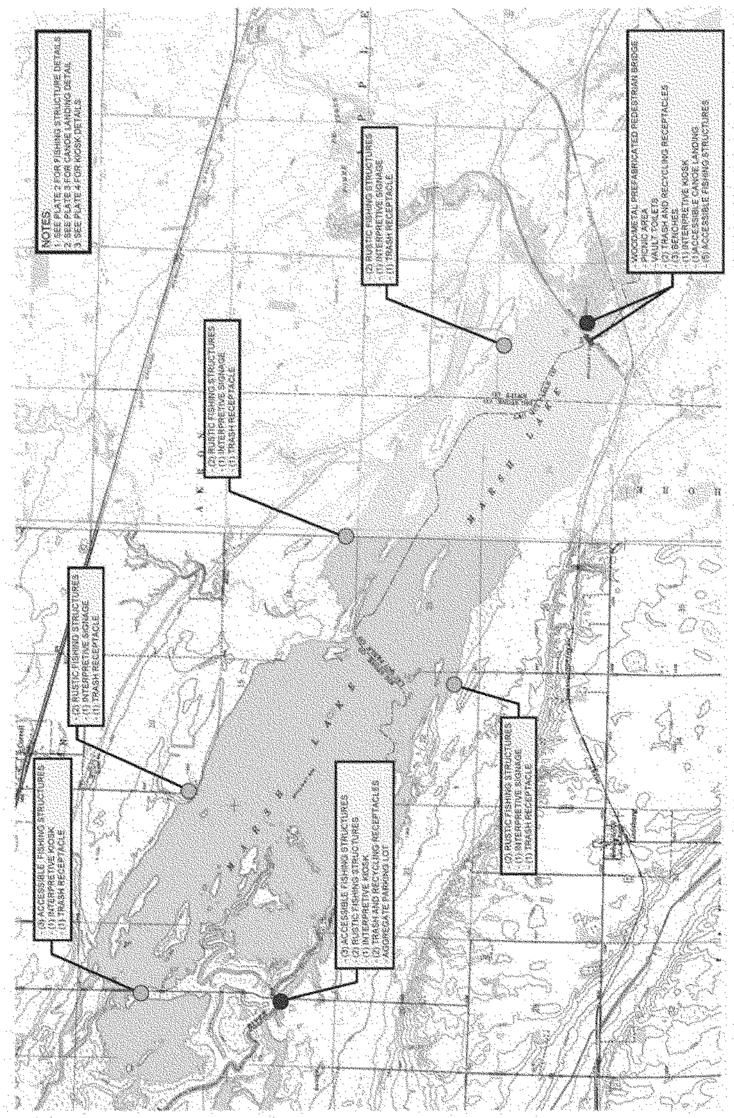
Breakout of Total Project Costs and Benefits
Marsh Lake Ecosystem Restoration - Recommended Plan

	Ecosystem Restoration
Total Project First Costs	$ 9,967,000
Interest During Construction (4.125%)	$ 214,000
Present Worth of Investment	**$ 10,181,000**
Annualized Total Project Costs	$ 500,000
Annual Operations and Maintenance Costs	$ 35,000
Total Annual Benefits (Habitat Units)	8400
Total Annual Benefits (Recreation)	$ 225,000

Rounded to nearest $1000



Ecosystem Restoration Features of the Recommended Plan



Recreation Features of the Recommended Plan

Table of Contents

1. Introduction

1.1 Purpose of Report

The purpose of this Feasibility Report and Environmental Assessment is to document the planning process for ecosystem restoration of the Marsh Lake area on the Minnesota River, to provide opportunity for participation in the planning process for river management partners and the public, to meet Corps of Engineers planning guidance and to meet National Environmental Policy Act (NEPA) requirements.

1.2 Study Authority

The Marsh Lake feasibility study was authorized by a Resolution of the Committee on Public Works of the U.S. House of Representatives, May 10, 1962. The resolution reads as follows:

> "Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors be, and is hereby, requested to review the report of the Chief of Engineers on the Minnesota River, Minnesota, published as House Document 230, 74th Congress, First Session and other pertinent reports, with a view to determining the advisability of further improvements in the Minnesota River Basin for navigation, flood control, recreation, low flow augmentation, and other related water and land resources."

1.3 Minnesota River Basin Reconnaissance Study

Funds were appropriated in Federal fiscal year 2003 to initiate the reconnaissance study. The reconnaissance study was completed in December 2004 (USACE 2004) and approved by the Corps Mississippi Valley Division in January 2005. The purpose of the reconnaissance study was to evaluate the potential for Federal interest in implementing solutions to flooding, navigation, low flow augmentation, recreation, ecosystem restoration, and other related water resource problems and opportunities in the Minnesota River Basin (MRB) in Minnesota, South Dakota, North Dakota, and Iowa.

The reconnaissance investigation was conducted in close coordination with the many agencies active in land and water resources management in the MRB, including the U.S. Fish and Wildlife Service (USFWS); Natural Resources Conservation Service (USDA); U.S. Geological Survey (USGS); Minnesota Department of Natural Resources (DNR); Minnesota Pollution Control Agency (MPCA); Minnesota Board of Water and Soil Resources (BWSR); University of Minnesota; Minnesota State University at Mankato; MRB Joint Powers Board; Metropolitan Council of the Twin Cities; local watershed districts; Clean Up the River Environment (CURE); Ducks Unlimited; and The Nature Conservancy. These agencies are committed to a Basin-wide watershed framework to address water resources problems and needs in the MRB. An electronic copy of the reconnaissance study report can be found at the following location:

http://www.mvp.usace.army.mil/environment/default.asp?pageid=93

The reconnaissance study resulted in the finding of Federal interest in and potential solutions to several existing water resources problems that warrant feasibility studies including this Marsh Lake Ecosystem Restoration Project, the Blue Earth River Ecosystem Restoration Project, and an Integrated Watershed, Water Quality and Ecosystem Restoration Analysis for the MRB. The Blue Earth River Watershed is located a considerable distance downstream from the Marsh Lake area and is unrelated to the Marsh Lake Ecosystem Restoration Project. The Minnesota River Integrated Watershed Study will provide a comprehensive evaluation of existing watershed conditions and may result in implementation measures that could further enhance ecosystem conditions at Marsh Lake. The Minnesota River Integrated Watershed Study is currently scheduled for completion in 2015.

The geographic scope of this project was negotiated between the sponsor and the Corps and includes Marsh Lake, adjoining floodplain and shorelines, the confluence of the Pomme de Terre River, Marsh Lake Dam and Lac qui Parle reservoir (Figure 1-2). A Project Management Plan (PMP) was developed in coordination with study partners and stakeholders for the Marsh Lake Ecosystem Restoration Project (Appendix A). A Feasibility Cost Sharing Agreement was signed in May 2007 with the DNR to conduct this study (Appendix B).

1.4 Purpose of the Marsh Lake Ecosystem Restoration Project

The purpose of this project is to restore the aquatic and riparian ecosystems in the Marsh Lake project area. Impoundment of Lac qui Parle and Marsh Lake, diversion of the Pomme de Terre River into Lac qui Parle, and river regulation have significantly altered the ecosystem state.

Aquatic ecosystem restoration is a primary mission of the Corps' Civil Works program, and is defined as achieving a "return of natural areas or ecosystems to a close approximation of their conditions prior to disturbance, or to less degraded, more natural conditions"(EP 1165-2-502.)

In some circumstances, as at Marsh Lake, a return to pre-disturbance conditions may not be feasible. In those instances, "the goal is to partially or fully reestablish the attributes of a naturally functioning and self regulating system." The goal of this project is to return the Marsh Lake area ecosystem to less degraded, more natural conditions by restoring natural functions and processes.

The original construction of the Marsh Lake Dam was intended to serve as a flood damage reduction measure as well as a recreational feature to the region, primarily through the creation of a static pool on the river. The intended flood damage reduction benefits provided by the Marsh Lake Dam are minor due to effectiveness of the Lac qui Parle Dam downstream. Marsh Lake is a popular recreation destination in the region as shown by visitor numbers. As with many projects constructed at the time, a full understanding of the ecology of the system was not of primary concern.

Since impoundment, Marsh Lake has undergone significant degradation of aquatic habitat due to a number of stressors including high sediment and nutrient loading, a fixed crest dam that prevents low seasonal water levels, high turbidity from wind-driven sediment resuspension, and abundant common carp that increase turbidity and graze off submersed aquatic vegetation and macroinvertebrates. Although Marsh Lake provides an open water area for migratory waterfowl to rest and islands for nesting colonial waterbirds, degradation of the aquatic ecosystem there limits habitat suitability for many species of fish and wildlife.

The underlying purpose and need for this project is to restore the degraded Marsh Lake ecosystem.

The stated goal of Marsh Lake Ecosystem Restoration Project is to "return the Marsh Lake area ecosystem to a less degraded and more natural condition by restoring ecosystem structure and functions." The intent of the Marsh Lake ecosystem restoration project is to increase variability in ecosystem processes, restore a more natural water level regime, aquatic habitat connectivity, and a vegetated lake ecosystem state.

1.5 Project Scope

1.5.1 Location

Marsh Lake Dam is located on the Minnesota River in western Minnesota (Figure 1-1). Lac qui Parle and Marsh Lake Reservoirs form boundaries for Lac qui Parle, Swift, and Big Stone Counties.

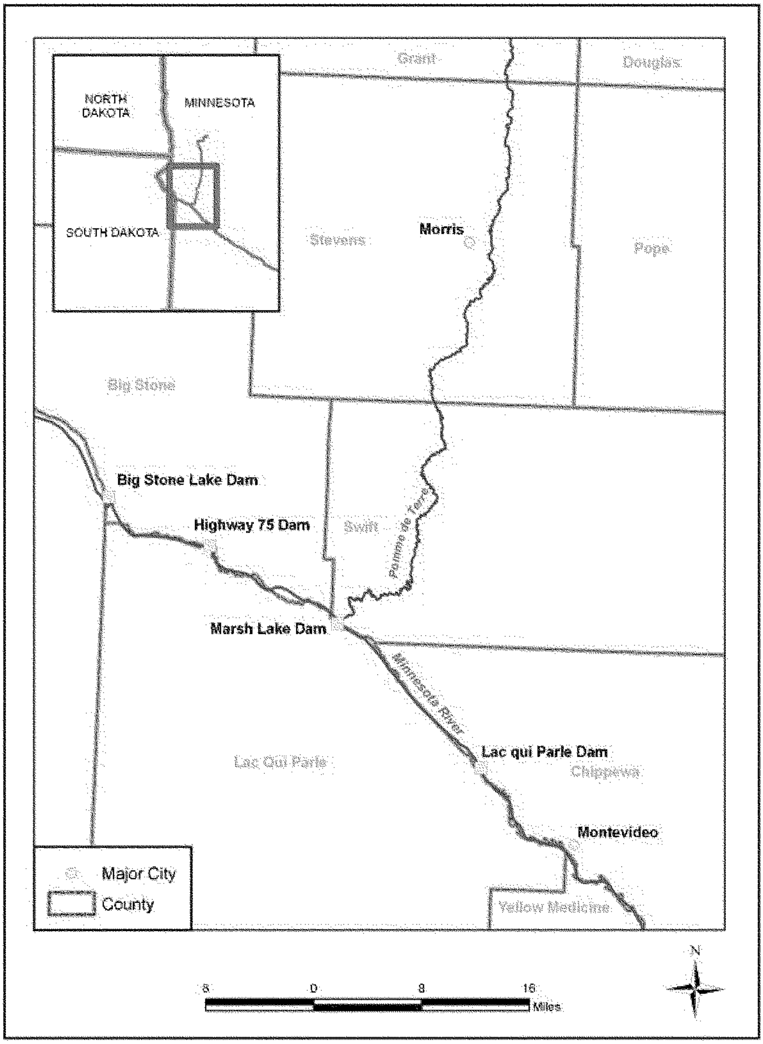


Figure 1-1. Location of Marsh Lake and the Lac qui Parle Flood Control and Water Conservation Project in the Upper Minnesota River Basin.

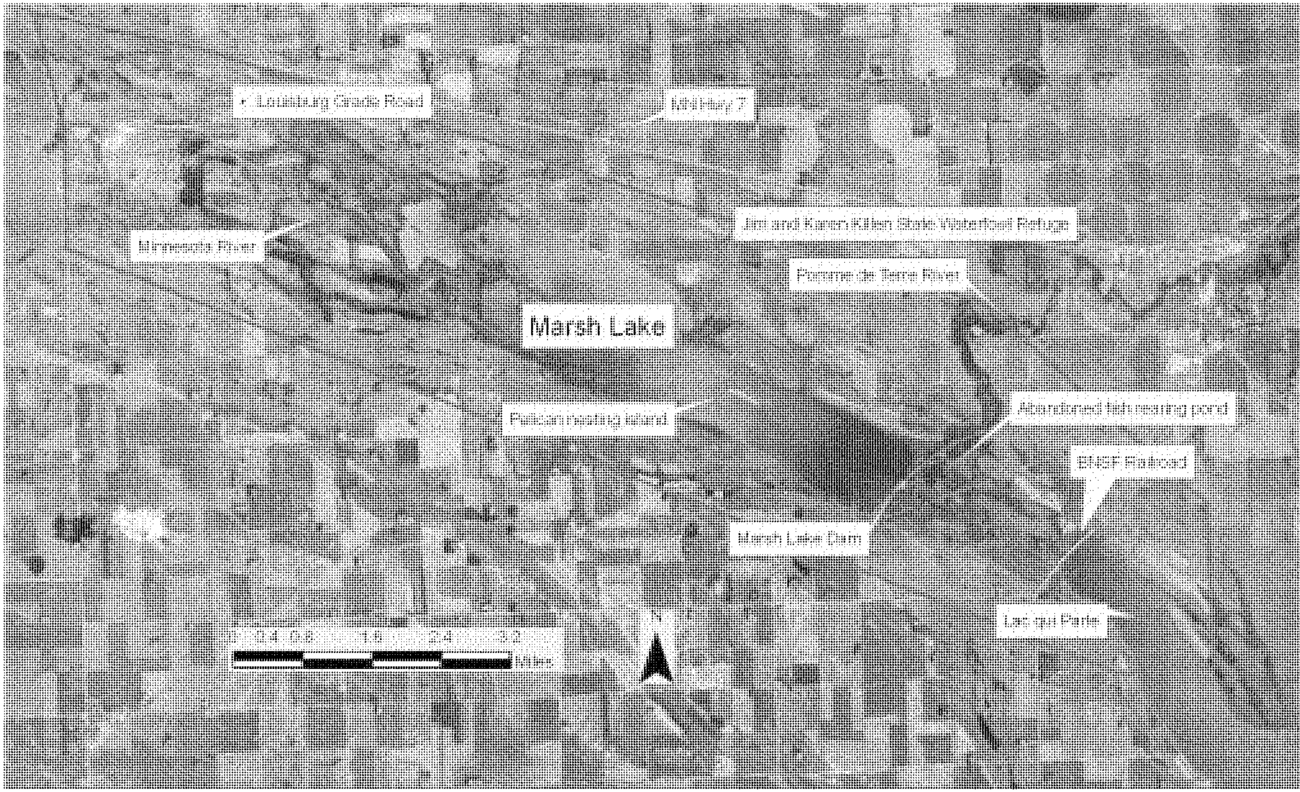


Figure 1-2. Marsh Lake project area boundary. Minnesota River flowing left to right. Marsh Lake Dam at right center. Pomme de Terre River entering from upper right. Farm Service Agency 2003 photo.

1.5.2 Geographic Scope

The geographic scope of this project includes Marsh Lake, adjoining floodplain and shorelines, the confluence of the Pomme de Terre River, Marsh Lake Dam and Lac qui Parle reservoir (Figure 1-2). There are many opportunities for ecosystem restoration present in the study area. The DNR is the non-Federal cost share sponsor for this study. The DNR has authority, funding and staff for ecosystem restoration and management of the Lac qui Parle Wildlife Management Area.

Because the condition of the Minnesota River ecosystems affects migratory birds and a flyway of international importance, the geographic scope of the project extends in effect to the range of the many species of migratory birds that breed in, migrate through and that stop to feed and rest in the Marsh Lake area. The project area is important to many species of migratory waterfowl with effects that extend beyond the immediate project area.

Condition of the Marsh Lake area ecosystems are greatly affected by land use in the upper Minnesota River Basin. Modification of the hydrology and land use in the Minnesota River Basin has been profound, converting former prairie, streams and wetlands into an extensively drained agricultural landscape dominated by row crops. This report does not address watershed and water quality management in the upper Minnesota River Basin. As documented in the Minnesota River Basin Reconnaissance Study report (USACE 2004), we recognize that many of the problems in the Marsh Lake area ecosystem are symptoms of larger watershed issues. Opportunities to further restore and contribute to the sustainability of Marsh Lake area ecosystems through actions in the greater watershed are being explored in the ongoing Minnesota River Basin Watershed, Water Quality and Ecosystem Restoration Study as recommended in the Minnesota River Basin Reconnaissance Report (USACE 2004). A feasibility cost share agreement for the Minnesota River Basin Watershed, Water Quality, and Ecosystem Restoration Study was signed by the Corps and the Minnesota River Environmental Quality Board in February 2009. The watershed study for the basin is currently under way and will identify ecologically and cost-effective alternatives for watershed improvement, water quality management, and ecosystem restoration throughout the Minnesota River Basin.

As a result of the reconnaissance study, the Lac qui Parle Wildlife Management Area (WMA) became the original geographic focus of the Feasibility Study due to the presence of Corps owned and operated structures at Lac qui Parle and Marsh Lake, ownership by the DNR over the WMA lands, and the willingness of the DNR to serve as the non-Federal Sponsor on the study. As the Feasibility Study progressed and alternative measures were screened (see Section 4), the scope of the study was further limited to a smaller geographic area within the WMA where a series of measures could be implemented that would improve the aquatic and riparian conditions primarily in and around Marsh Lake (Figure 1-2). This geographic area is referred to throughout the report as the Marsh Lake project area, which includes Marsh Lake, the Pomme de Terre River outlet, the Marsh Lake Dam, and the upper portion of the Lac qui Parle reservoir. While the Feasibility Study utilizes a watershed approach, additional measures to reduce sediment loading from sources within the watershed are being investigated as a part of the Minnesota River Basin Integrated Watershed Study.

1.5.3 Temporal Scope

The temporal scope of the project is a period of analysis of 50 years, beginning in 2014 and ending in 2063.

1.6 Project Planning

The Marsh Lake Ecosystem Restoration Project is being planned following the standard Corps of Engineers six-step planning process:

1. Identify problems, opportunities and constraints.
2. Inventory existing conditions and forecast future conditions.
3. Formulate alternatives.
4. Evaluate alternatives.
5. Compare alternatives.
6. Select a recommended plan.

This study has also been drafted to comply with NEPA, with an integrated environmental assessment.

1.7 Existing Water Projects, Prior Studies and Reports

1.7.1 Existing Projects

Lac qui Parle Flood Control and Water Conservation Project

The Marsh Lake Dam was built in the late 1930's by the State of Minnesota and the Federal Works Progress Administration as part of the multi-purpose Lac qui Parle Water Control Project. The project was authorized by the Flood Control Act of 1936, Public Law 74-738 and was partially constructed by the Works Progress Administration. The Corps of Engineers completed project construction between 1941 and 1951. Operation of the project was transferred from the State of Minnesota to the Corps of Engineers in 1950.

Components of the Lac qui Parle project include the Lac qui Parle Dam (Figure 1-4), the Chippewa River Diversion (Figure 1-5), and the Marsh Lake Dam (Figure 1-6). An overview of the project components is included below in Figure 1-3.

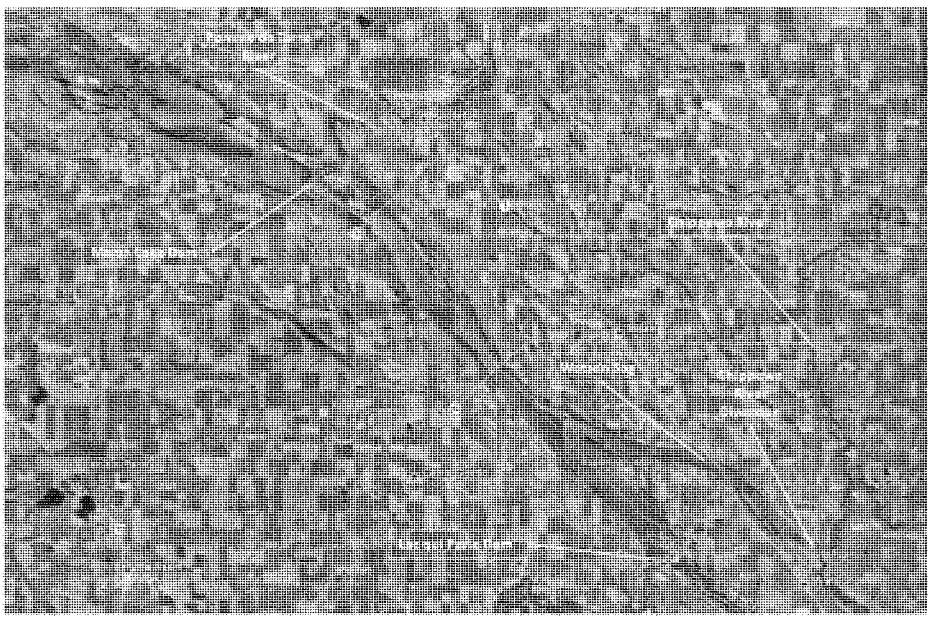


Figure 1-3. Overview of Lac qui Parle Project Components

The Lac qui Parle Dam impounds the natural Lac qui Parle formed on the Minnesota River by the delta of the Lac qui Parle River. The Chippewa River Diversion reduces downstream Minnesota River flood flows at Montevideo, Minnesota, by diverting a portion of the Chippewa River floodwaters into Lac qui Parle through the Watson Sag (a former channel of the Glacial River Warren, now a shallow bay of Lac qui Parle).

Marsh Lake Dam is a fixed-crest dam constructed to hold a conservation pool in the upper portion of the Lac qui Parle. An abandoned fish rearing pond is located on the downstream side of the Marsh Lake dam embankment.

The Minnesota DNR's Lac qui Parle Wildlife Management Area surrounds both Lac qui Parle Lake and Marsh Lake.

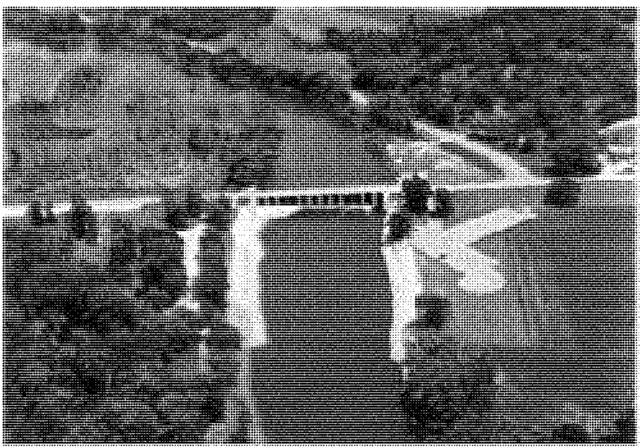


Figure 1-4. Lac qui Parle Dam on the Minnesota River, looking upstream.

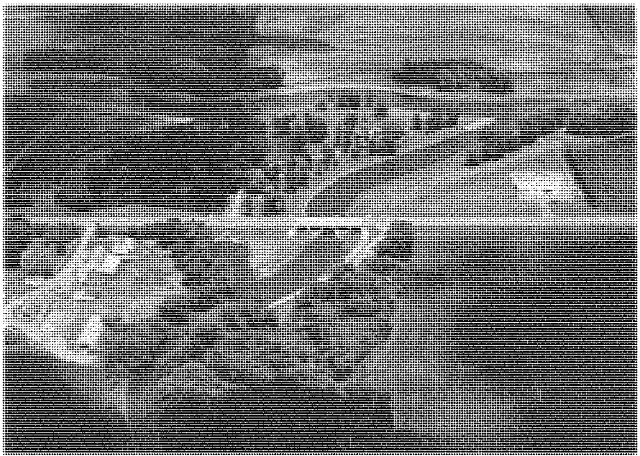


Figure 1-5. Chippewa River Diversion on the Chippewa River near Watson, Minnesota. Diversion structure is under bridge at center, Watson Sag Channel at upper left.

Figure 1-6. Marsh Lake Dam on the Minnesota River. Abandoned fish rearing pond at upper right on downstream side of dam.

Table 1-1. Pertinent data about Lac qui Parle and Marsh Lake.

Lac qui Parle Dam	Concrete dam 237 ft long with 4 17 ft-wide bays: Bay 2 with 3 4 ft x 4 ft vertical lift gates for low flow regulation. Bays 1, 3, 4 with 2 6 ft x 8 ft vertical lift gates. Spillway with crest at 934.2 ft and 8 17-ft wide bays. Bays 5, 6, and 7 are uncontrolled. Bays 8 through 12 have moveable steel bulkheads. Dam is 32 ft high. Emergency spillway 2500 ft long surfaced roadway
Lac qui Parle	Conservation pool elevation 933.0 ft in summer, 934.0 in fall and winter.
	Full pool elevation 941.1 ft
	Reservoir area at conservation pool 7700 acres Maximum depth 17 ft
Marsh Lake Dam	11,800 ft-long rolled earth dam
	112 ft – long concrete overflow spillway crest elevation 937.6 ft (not an operable spillway)
	2 ft x 2 ft vertical lift gate low flow outlet sill at 932.6 ft
	90 ft long emergency spillway with crest at 940.0 ft
Marsh Lake Reservoir	Conservation pool elevation 937.6 ft
	Full pool elevation 941.5 ft
	Reservoir area at conservation pool 5,000 acres

Modifications to River Regulation at the Lac qui Parle Project

The water control plan (USACE 1995) for the Lac qui Parle Project describes low flow, routine, and flood control regulation of the project. The water control plan provides a history of river regulation at the project.

Following completion of the Lac qui Parle dam in 1939, the conservation pool was set at 934.2 feet year-round. The State of Minnesota lowered the conservation pool elevation to 932.0 ft in 1946 in an effort to provide more flood water storage. Following meetings with stakeholders the conservation pool elevation was reset to 932.1 ft that same year.

The project was transferred to the Corps of Engineers in 1950 and a spring drawdown to 926.0 ft was adopted. Starting in 1968, the pool was raised in the fall to 934.2 ft from 15 October to 15 November and held there over winter to help prevent fish kills. The spring drawdowns to 931.2 ft or lower were done between 15 January and 15 March. In 1970 the regulation plan was changed to start the fall pool rise on 1 August.

In 1979 the summer conservation pool elevation was changed to a band between 932.75 and 933.0 ft. In 1982 the spring drawdown period was changed to 21 February to 10 March.

Following completion of a Reservoir Operating Plan Evaluation (USACE 1989), the regulation plan for the Lac qui Parle project was changed to reduce the duration of high stages on the reservoir and to reduce flood damages downstream. The current plan has a summer conservation pool elevation of 933+/- 0.2 ft and a fall and winter pool level of 934.0 +/- 0.2 ft. The spring drawdown occurs from 1 March to 15 March.

The Marsh Lake dam does not have an operable spillway. It is a fixed-crest dam with a crest elevation of 937.6 ft. A two-foot gated box culvert low flow outlet has a sill elevation of 932.6 ft.

Existing Projects Upstream on the Minnesota River

Big Stone Lake

Big Stone Lake is a 26-mile-long 12,610-acre natural floodplain lake at the headwaters of the Minnesota River formed by the delta of the Whetstone River. A stoplog water control structure was built by the State of Minnesota in the mid-1930s to control the level of Big Stone Lake. The Whetstone River was diverted to discharge into the Minnesota River between Big Stone Lake and the water control structure. The State ceased operating the water control structure in 1947. The Big Stone Lake-Whetstone

River Modification Project was authorized by the Flood Control Act approved 27 October 1965. The Big Stone Dam was replaced by the Corps of Engineers as part of the Big Stone Lake-Whetstone River Flood Control Project. The new dam and channel modifications were completed in 1985. The Upper Minnesota River Watershed District owns and operates Big Stone Dam.

Highway 75 Dam

Highway 75 Dam was constructed by the Corps of Engineers as part of the Big Stone Lake-Whetstone River Flood Control Project and was completed in 1974 (Figure 1-7). The authorized project purposes are flood damage reduction and water conservation. The Highway 75 Dam impounds approximately 5,000 acres of water. A water control structure was included in the dam to allow manipulation of water levels in the large wetland impoundment. Lands for the project were initially acquired by the Corps of Engineers in 1971, and were then transferred to the U.S. Fish and Wildlife Service in 1975. All the lands (11,115 acres) acquired by the Fish and Wildlife Service were incorporated into the land base for Big Stone National Wildlife Refuge. The Corps of Engineers operates and maintains the Highway 75 Dam

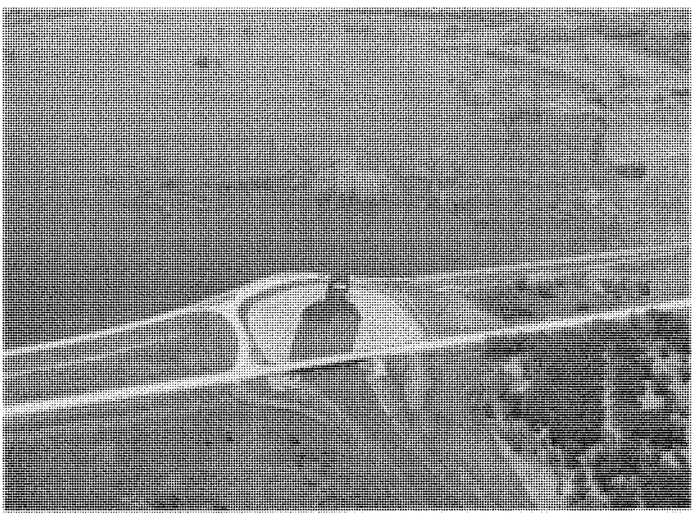


Figure 1-7. Highway 75 Dam on the Minnesota River.

1.7.2 Prior Studies and Reports

Reports pertinent to the Marsh Lake ecosystem restoration project include those listed in the References section below. The Corps conducted a number of studies to identify solutions for reducing flood damages on the upper Minnesota River that led to the Big Stone Lake – Whetstone River Project and the Lac qui Parle Project (USACE 1950, 1960, 1961, 1966). The Corps conducted a Reservoir Operating Plan Evaluation (ROPE) study of the Lac qui Parle project and produced a report (USACE 1989) that led to modifications of the reservoir operating plan. The Minnesota River Basin Reconnaissance Study report (USACE 2004) was completed in December 2004 and approved in January 2005. The Marsh Lake Ecosystem Restoration feasibility study was recommended in that report.

This feasibility study and environmental assessment is not a supplement to an earlier action. There have been only three National Environmental Policy Act (NEPA) environmental assessments prepared about the Lac qui Parle project in recent years:

- Reservoir Operating Plan Evaluation (ROPE) Environmental Assessment, 1989.

- Long-Term Maintenance Dredging Plan of the Chippewa River and Chippewa River Diversion Channel Environmental Assessment, December, 2004

- Watson Sag Diversion Channel Levee Repair Environmental Assessment, September 2005.

There have been many studies of the hydrology, sediment movement, water quality and aquatic habitat conditions in the Minnesota River Basin including USACE (1969), Southern Minnesota Rivers Basin Commission (1977), Van Alstine (1987), MPCA (1994), James and Barko (1995). A compilation of Minnesota River Basin data, information, and reports is maintained by the Minnesota River Basin Data Center at Mankato State University: http://mrbdc.mnsu.edu/

2. Existing and Future Without-Project Conditions

This section presents a summary of existing conditions in the Marsh Lake project area followed by a forecast of future conditions without a project to restore the Marsh Lake area ecosystem.

2.1 Marsh Lake

Marsh Lake is a river floodplain lake originally created by the delta formed where the Pomme de Terre River joins the Minnesota River. Marsh Lake once was a shallow lake surrounded by seasonally-flooded floodplain forest, prairie and wetland habitat.

Today Marsh Lake is an approximately 5,000-acre shallow reservoir (Figure 2-1). The fixed-crest Marsh Lake Dam was constructed to hold a conservation pool in the upper part of the Lac qui Parle. The Works Progress Administration constructed the Marsh Lake Dam and rerouted the Pomme de Terre River into Marsh Lake between 1936 and 1939. The reservoir was first filled in the spring of 1939. The Corps of Engineers improved the dam between 1941 and 1951 as part of the Lac qui Parle Project. The project was operated by the State of Minnesota until 1950, when operation and maintenance responsibilities were transferred to the Corps of Engineers.

The upper end of Marsh Lake is divided by the Louisburg Grade Road (Figure 2-1). There are three sets of culverts under the road connecting the north part with the main body of the lake. The culverts do not have gates or other control structures. The Louisburg Grade Road crosses the Minnesota River on a bridge.

A fish rearing pond (now abandoned) is located on the downstream side of the Marsh Lake Dam (Figure 2-1). The water control inlet and outlet structures (gated culverts) for the fish rearing pond no longer function.

The Jim and Karen Killen State Waterfowl Refuge on the north side of Marsh Lake (Figure 2-1) has a 110-acre sub-impoundment on a local drainage way and a system for pumping water to control water levels in the refuge. The Killen refuge area is managed as a moist-soil unit to provide food for migrating waterfowl.

Average annual water level on Marsh Lake is 938.3 ft. The crest elevation of the fixed crest spillway in the Marsh Lake Dam is 937.6 ft. Approximately 3,000 of the 5,000 acres of Marsh Lake are less than 3 feet deep when the lake is at the level of the fixed crest spillway (Figure 2-2).

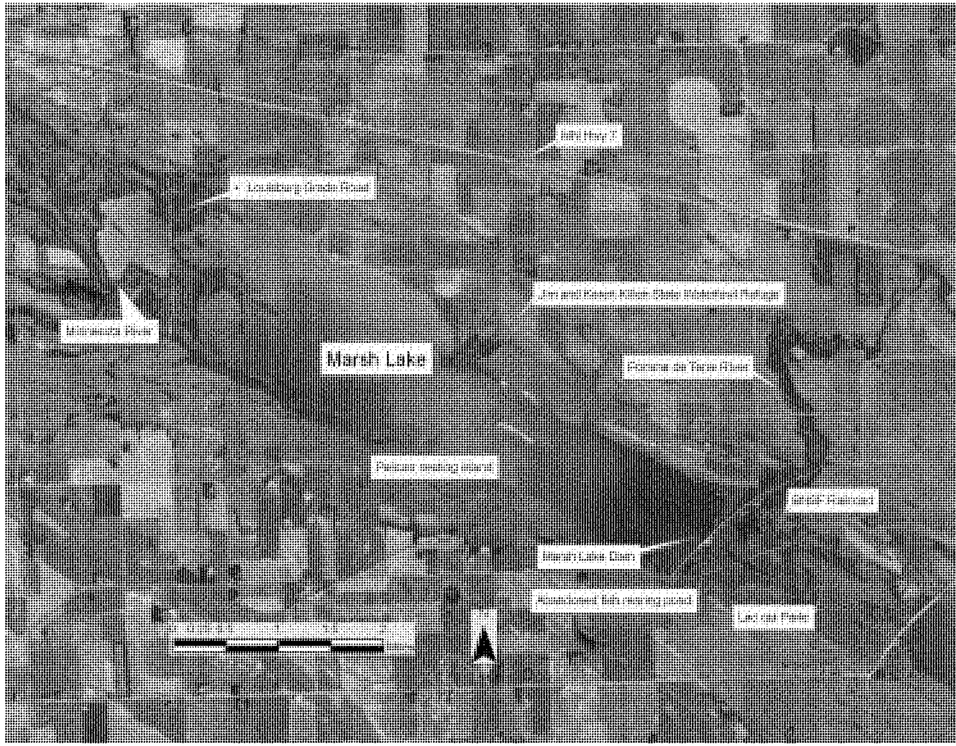


Figure 2-1. Marsh Lake. Minnesota River flowing left to right. Marsh Lake Dam at lower right. Pomme de Terre River entering from middle right. Farm Service Agency 2003 photo.

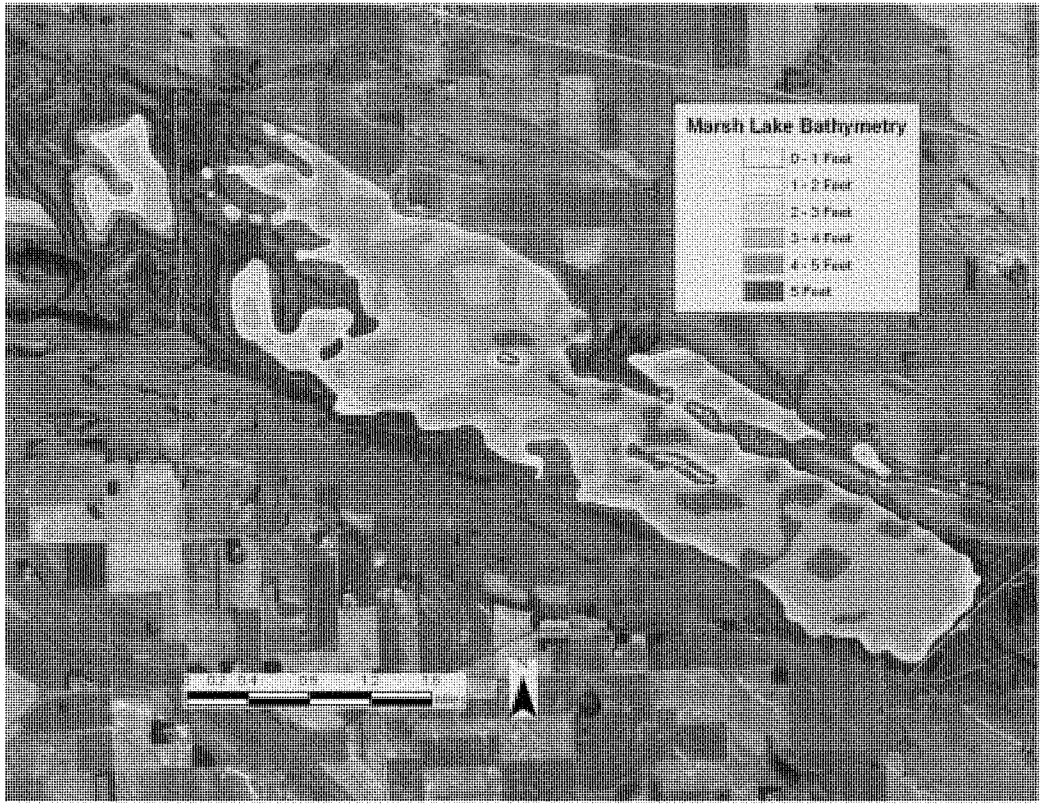


Figure 2-2. Marsh Lake bathymetry (from 2003 DNR survey data).

2.1.1 Marsh Lake Dam

The Marsh Lake Dam is an earth-fill structure 11,800 feet long with an average top elevation of 950.0 feet (Figure 2-1). The service spillway is a concrete fixed-crest overflow section 112 feet wide with a crest elevation of 937.6 feet. A grouted riprap emergency spillway immediately southwest of the service spillway is 90 feet wide with a crest elevation of 940.0 feet. The dam also has a 2-foot-square gated low flow outlet conduit with a sill elevation of 923.6. Unlike the Lac qui Parle Dam downstream, the Marsh Lake Dam cannot be operated to manage water levels in Marsh Lake (Figure 2-2).

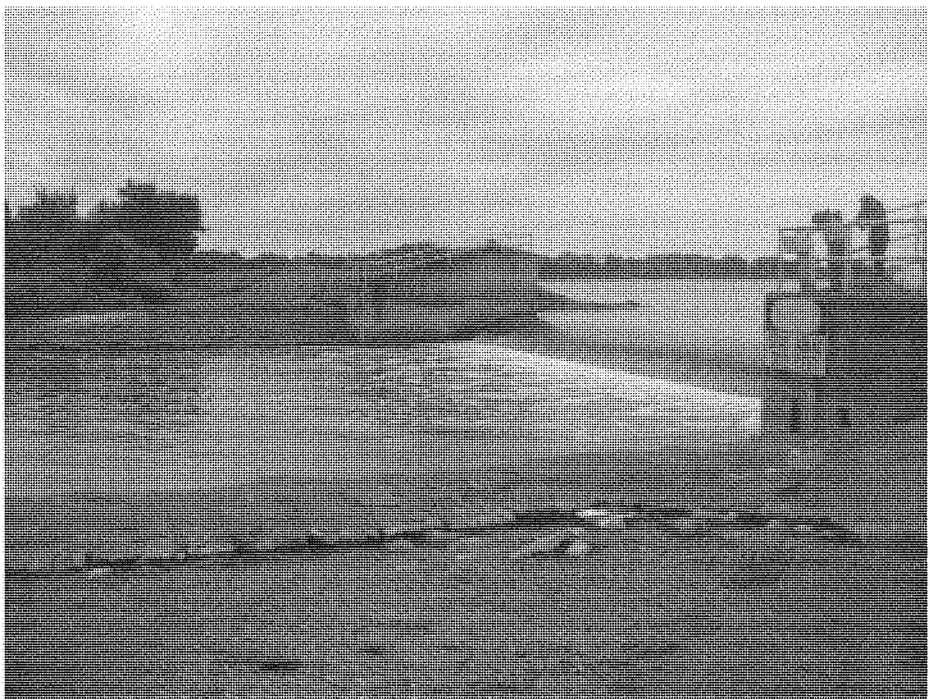


Figure 2-3. Marsh Lake Dam.

2.2 Hydrology

The hydrologic regime of the Upper Minnesota River Basin has been changed markedly by conversion of prairie to cropland, extensive drainage of wetlands, expansion of the artificial drainage network for agriculture with ditches and subsurface drains, and by impoundment and river regulation.

2.2.1 Minnesota River Hydrology

The Minnesota River originates at the outlet of Big Stone Lake, flows through the Highway 75 impoundment and then into Marsh Lake and Lac qui Parle Reservoir, draining an area of 4050 mi^2. The mean annual flow rate at the gage just downstream of the Lac qui Parle Dam is 766 cfs. Peak flow of 30,100 cfs occurred on April 14, 2001. The hydrologic regime of the Minnesota River today is flashy with high discharge during spring runoff events and summer thunderstorms, and very low flows near zero during extended summer dry periods and in winter (Figure 2-4).

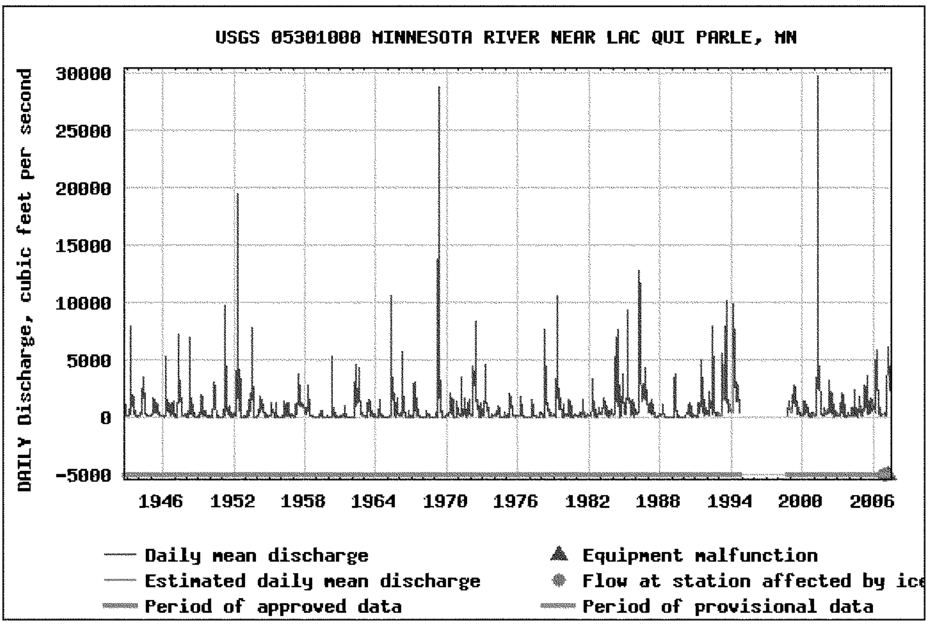


Figure 2-4. Minnesota River daily mean discharge 1946 – 2007.

2.2.2 Pomme de Terre River Hydrology

The Pomme de Terre River is a tributary of the Minnesota River. The Pomme de Terre River originates in western Otter Tail County and flows 106 miles southward through the cities of Barrett, Morris and Appleton to its confluence with the Minnesota River southwest of Appleton in Swift County. Most of the 875 mi^2 watershed was formerly prairie, but now row crop agriculture is the predominant land use on 81 percent of the watershed. Many of the former wetlands and non-contributing areas in the watershed have been drained. The total length of the stream network is 751 miles of which 616 miles are intermittent streams and 134.6 miles are perennial streams. There are a number of small dams in the watershed including a dam on the Pomme de Terre River in Morris.

Table 2-1. Streams in the Pomme de Terre River watershed (USGS data).

Stream Name	Total Stream Miles	Total Perennial Stream Miles	Total Intermittent Stream Miles
Artichoke Creek	2.7	0.0	2.7
Dry Wood Creek	10.1	3.2	6.9
Muddy Creek	31.5	11.1	20.4
Pelican Creek	12.4	12.4	0.0
Pomme de Terre River	105.9	105.9	0.0
Total Named Streams	162.6	132.6	30
Total Major Watershed Streams	750.7	134.6	616.1

The annual mean flow rate at Appleton during the 1936 – 2006 period of record was 134 cfs. The highest flow rate was 8,890 cfs on April 7, 1997, and occurred in part due to a dam failure at Appleton. Peak flows occur during spring runoff. Groundwater base flow maintains river discharge at about 100 cfs much of the time. The river flow occasionally ceases in winter and during extended periods of dry weather.

The lower part of the Pomme de Terre River was diverted into Marsh Lake when the Marsh Lake Dam was constructed.

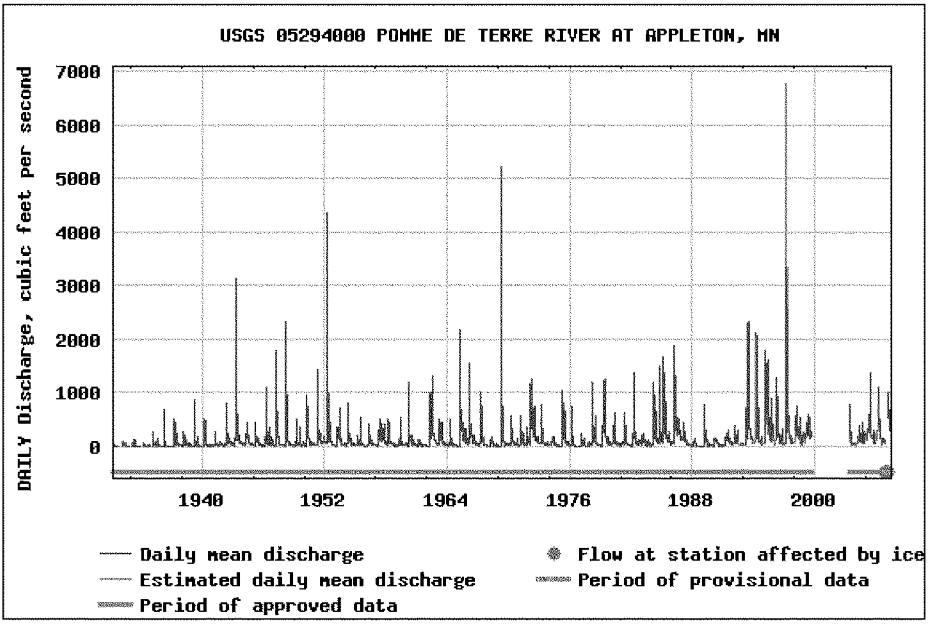


Figure 2-5. Pomme de Terre daily mean discharge at Appleton 1936 – 2007.

2.2.3 Marsh Lake Hydrology

Marsh Lake (Figure 2-2) covers approximately 5000 acres at the project pool elevation. The minimum project pool elevation, set by the fixed-crest Marsh Lake Dam, is 937.6 ft. At the average annual water level of 938.3, Marsh Lake covers 6100 acres. Water levels on Marsh Lake are characterized by rapid rises during spring runoff and thunderstorm events (Figure 2-6).

Marsh Lake provides flood water storage. The stage on Marsh Lake is dependent on inflow and outflow from the reservoir. The pool rises when inflow is higher than outflow. High pool elevations in Lac qui Parle Reservoir can affect stages in Marsh Lake by reducing the rate of outflow from Marsh Lake Dam.

Marsh Lake provides some flood damage reduction benefit because of the head loss across the Marsh Lake Dam during high water events. Head losses through the

Marsh Lake Dam during floods are quite variable but commonly about two feet. Head losses of 4.7 and 1.2 feet were observed for the large 1997 and 2001 floods respectively. The variability in head loss between Marsh Lake and Lac qui Parle is due to the timing and magnitude of discharge from the inflowing rivers (Minnesota River, Pomme de Terre River and Lac qui Parle River). The pool elevation of Marsh Lake is always higher than on Lac qui Parle. The floodwater storage in Marsh Lake provides some flood damage reduction benefits to downstream areas.

Because of the fixed crest Marsh Lake Dam, there is no 'normal pool' elevation. The pool level is typically around elevation 938.3 feet with a tailwater of around 934.0 feet during normal non-flood conditions.

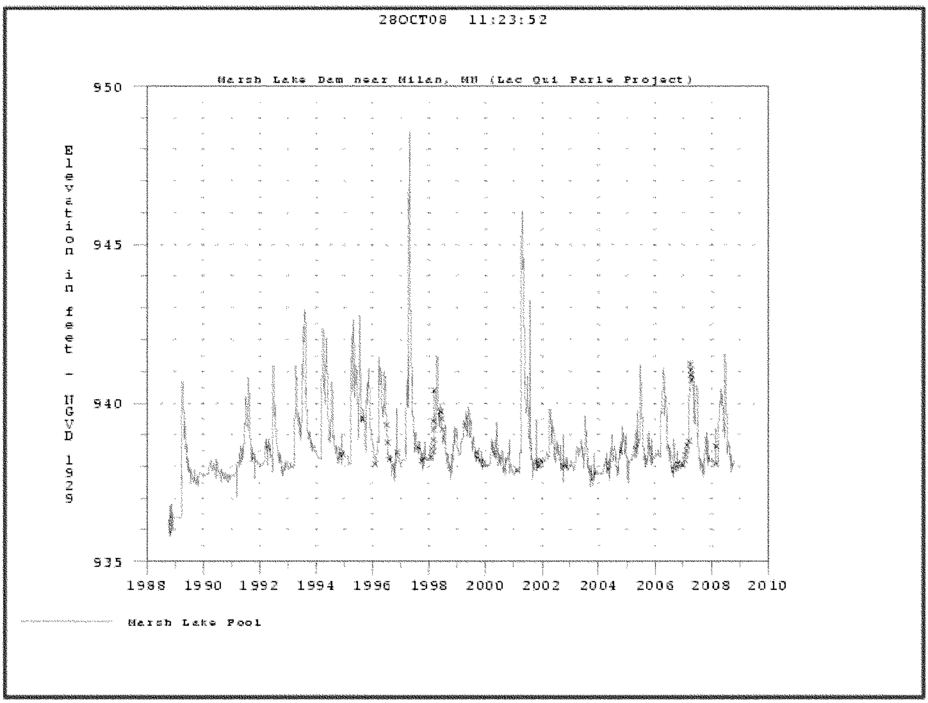


Figure 2-6. Marsh Lake stage hydrograph October 1, 1988 to October 1, 2008.

2.2.4 Lac qui Parle Hydrology

Lac qui Parle reservoir covers approximately 7,700 acres at the conservation pool elevation of 933.0 ft. As described for Marsh Lake, the stage hydrograph of Lac qui Parle is flashy, with periods of high water during spring runoff and summer thunderstorm events (Figure 2-7). The water control plan specifies discharge as necessary starting March 1 to achieve a drawdown to elevation 933.0 ft by March 15. From March 16 through May 15, discharge inflow and hold pool elevation at 933.0 +/- 0.2 ft or discharge the minimum flow of 20 cfs whichever is greater. From May 16 through August 31, discharge inflow to hold the pool at 933.0 ft +/- 0.2 ft. Starting on September 1, raise the pool to elevation 934.0 ft, and then hold this pool elevation through February.

During non-flood periods, the maximum release from Lac qui Parle Dam is 2500 cfs. During times when inflows are greater, the pool level rises. Maximum flood control storage when Lac qui Parle is at 941.1 ft and Marsh Lake is at 941.5 ft is 162,000 acre-feet.

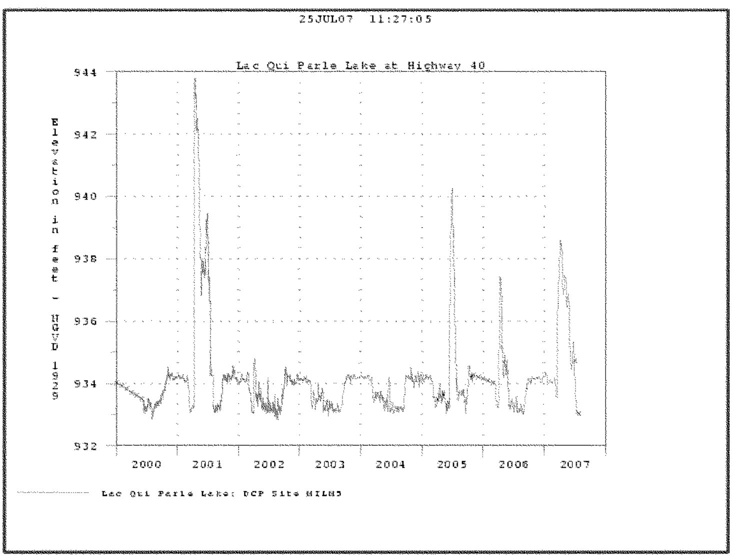


Figure 2-7. Stage hydrograph of Lac qui Parle January 2000 through July 2007. Note the summer water levels at elevation 934 and March drawdowns to elevation 933.0.

2.3 Sediment Loading to Marsh Lake

Loadings of seston (suspended sediment and particulate organic matter) to Marsh Lake generally increase in conjunction with higher Minnesota River flow. During high inflow periods, the Minnesota River exhibited higher loading rates of suspended sediment than the Pomme de Terre River (James and Barko 1995). During the 1991-1992 June – September period studied by James and Barko (1995), the Minnesota and the Pomme de Terre Rivers each contributed about 50 percent of the average daily seston load to Marsh Lake. During the June-September period monitored in 1991, the Minnesota River contributed 439,200 kg (473 tons) of seston and the Pomme de Terre River contributed 378,200 kg (306 tons) of seston to Marsh Lake.

Based on suspended sediment monitored on the Chippewa River by the U.S. Geological Survey (USGS) and adjusted for drainage area, the Pomme de Terre is estimated to yield 19,161 tons/year, or 8.2 acre-feet of suspended sediment annually. Under existing conditions, the Pomme de Terre River delivers its entire sediment load to the Marsh Lake reservoir, where the bed load settles out and forms the delta at the mouth of the river (Figure 2-8). A dam failure event on the Pomme de Terre River at Appleton in 1997 mobilized a large volume of sediment, contributing to the delta in Marsh Lake. Most of the suspended sediment delivered by the Pomme de Terre River flows from the delta area along Marsh Lake Dam to the overflow spillway, where it enters the Minnesota River at the upper end of Lac qui Parle.

The Minnesota River delivers little bed load sediment into Marsh Lake because of the trapping effect of the Highway 75 impoundment upstream. Rates of total (bed load and suspended) sediment loading and sediment accumulation in Marsh Lake have not been measured.

Figure 2-8. Pomme de Terre River delta where it enters Marsh Lake. Looking north from the Marsh Lake Dam.

2.4 Wind-generated Waves and Sediment Resuspension on Marsh Lake

Marsh Lake is a 7-mile long lake oriented southeast to northwest in a windy area. Wind fetch is the length of open water in the direction that the wind is blowing. Wind-driven wave action on Marsh Lake can be powerful, resuspending bottom sediment and causing shoreline erosion (James and Barko 1995)

James and Barko (1995) found that sediment resuspension was low in Marsh Lake in 1991 when submersed aquatic vegetation was densely established. In 1992, vegetation was almost completely absent and sediment was readily resuspended by wind-driven wave action.

Storm inflows during the summer of 1991 and 1992 caused increases in the pool elevation and thus the wave length required to resuspend the sediment surface. Mean daily wind velocities were generally lower during June through August, further reducing the potential for sediment resuspension. In contrast, mean daily wind velocities and sediment resuspension were generally greatest in Marsh Lake during the late spring (i.e., May and early June) and the autumn (i.e., late August and September) of both years.

Measurements taken by Barko and James (1995) indicated that high wind velocities greater than 12 km/hr (7.5 mph) from any direction caused sediment resuspension in Marsh Lake when it was unvegetated in 1992 (Table 2-2). In 1991 when the lake was vegetated, the critical wind speed for sediment resuspension was 20 km/hr (12.5 mph).

Export of resuspended sediment from Marsh Lake to Lac qui Parle Lake occurred primarily when winds were blowing from the northwest toward the dam, with maximums of around 150,000 kg/d (165 T/d). Wind set-up raises water level at the dam, contributing to discharge of water and sediment over the fixed-crest dam. While sediment resuspension occurred relatively frequently in Marsh Lake during 1992 (i.e., 32 percent of the time during the April through July growing season), discharge of resuspended sediment occurred much less frequently (i.e., 15 percent) in 1991, due to the role of wind direction and vegetation in regulating sediment resuspension and discharges (Barko and James 1995).

A wind fetch model (Rhoweder et al. 2008) was applied to Marsh Lake to simulate wind-driven waves and potential for sediment resuspension (Appendix J) The wind fetch model incorporates the wind speed and direction data (Figure 2 – 8) and simulates threshold wind speeds for sediment resuspension for different fetch lengths and water depths. The wind fetch model simulates the shear force exerted on the lake bed from rotational wave currents. Sediment is resuspended at relatively low wind speeds when the wind direction is on the long axis of the lake, either from the northwest or from the southeast (Figure 2-10).

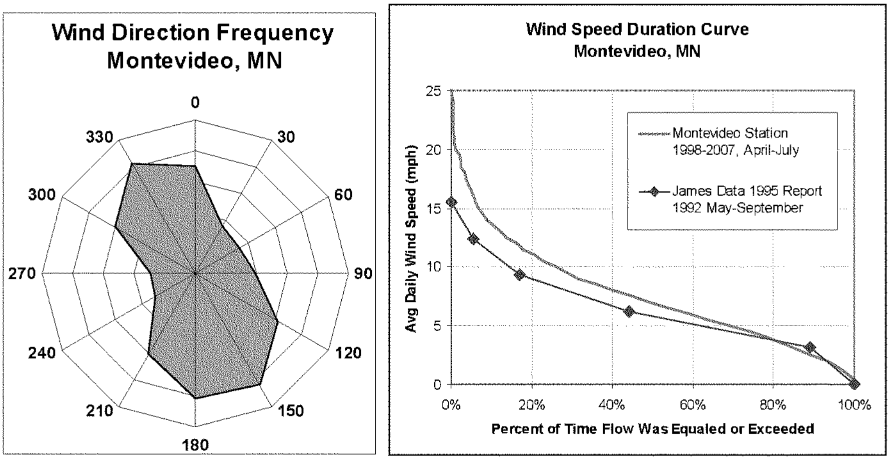


Figure 2-9. Wind direction and speed at Montevideo, Minnesota during April through July 1998 – 2007.

Table 2-2. Estimated percent of the Marsh Lake bed disturbed by wave action at various wind speeds and directions in 1992 when Marsh Lake was unvegetated (from James and Barko 1995).

Wind Speed		**Wind Direction**		
km/h	**NE**	**SE**	**SW**	**NW**
5	22	22	17	17
10	49	67	37	75
15	86	95	81	100
20	100	100	100	100

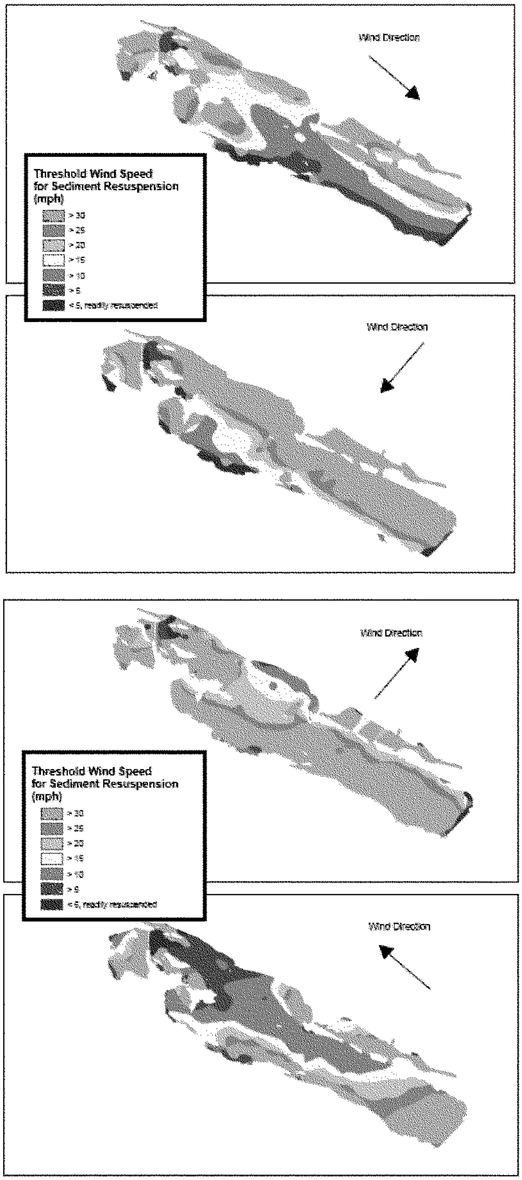


Figure 2 – 10. Threshold wind speeds for sediment resuspension in Marsh Lake.

2.5 Shoreline Erosion on Marsh Lake

Wind-driven wave action has eroded islands and shorelines on Marsh Lake. The eroding shorelines are mostly in the northern part of the lake where wind fetch is the greatest and where emergent plants are not present along the shoreline (Figure 2 - 11). Several islands that were present following impoundment have been eroded away. The large island used by nesting American pelicans has also been eroded. The rates of shoreline erosion have not been measured.

On an October 2008 site visit, we examined many of the eroding shoreline areas (Figures 2-12, 2-13). Marsh Lake has an abundance of large boulders in the lake bed, a legacy from the Glacial River Warren and the granite outcroppings in the area. Wave action and ice push has, over time, effectively rip-rapped and stabilized the eroding shoreline areas. It does not appear that shoreline erosion on Marsh Lake will continue.

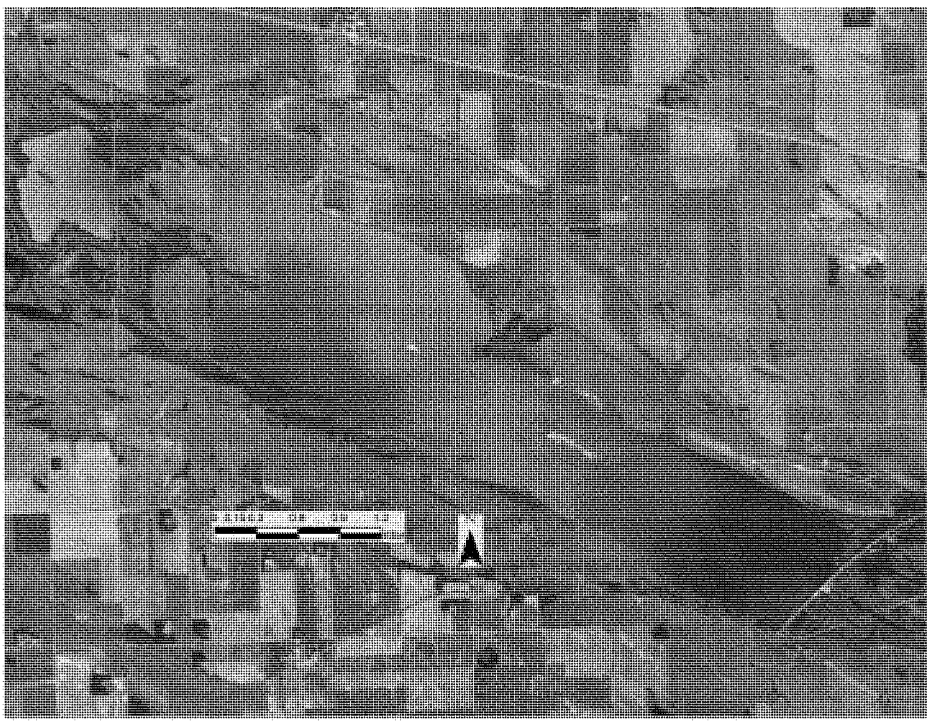


Figure 2 - 11. Eroding shorelines on Marsh Lake shown in red. The red dots in the center are the locations where islands have eroded away.

Figure 2-12. Eroding shoreline along the north side of Marsh Lake armored by native boulders. October 9, 2008 photo.

Figure 2-13. Eroding shoreline on an island in Marsh Lake armored by native boulders. October 9, 2008 photo.

2.6 Water Quality

The Minnesota River, Marsh Lake and the Pomme de Terre River are usually turbid with suspended sediment. Secchi disc transparency is typically less than one foot.

According to accounts of early explorers, when the watersheds of the upper Minnesota and Pomme de Terre Rivers were mostly covered with prairie, the rivers were vegetated and ran clear (Waters 1977).

Today, the system receives considerable loading of sediments and the plant nutrients nitrogen and phosphorus from the intensively row-cropped watershed. Alteration of the stream drainage network by subsurface drain tiles, ditching and stream channelization has altered the hydrology of tributaries to the Minnesota River, making them more flashy and caused sediment to be mobilized from the bed and banks of the tributaries.

The upper Minnesota River is alkaline, with total alkalinity generally over 250 mg/L. Sulfate concentrations are high, generally over 150 mg/L. These alkaline conditions are characteristic of prairie water bodies in the region and influence the species of plants and zooplankton that can grow in Marsh Lake.

The Minnesota River in Marsh Lake and Lac qui Parle are on the Minnesota Pollution Control Agency's (MPCA) Section 303(d) Clean Water Act list of impaired waters. The impairment shown on the 2006 list is for mercury, which prompted a fish consumption advisory for walleye of not more than 1 meal per week for the general population and not more than 1 meal per week of carp, northern pike, yellow perch and walleye for women who are or may become pregnant and for children under 15 years of age (Minnesota Department of Health 2008).

The Pomme de Terre River is on the MPCA's 2006 impaired waters list with impairments by fecal coliform bacteria, fish IBI (index of biological integrity), mercury and turbidity.

The Minnesota Department of Health (2008) has issued fish consumption advisories for the Minnesota River and the Pomme de Terre River because of mercury contamination in fish. The current advisory cautions the general population to eat no more than one meal per week of walleye and not more than 1 meal per week of carp, northern pike, yellow perch and walleye for women who are or may become pregnant and for children under 15 years of age.

Dissolved oxygen in the Minnesota River, the Pomme de Terre River and Marsh Lake is usually higher than the standard of 5 mg/l for protection of aquatic life. In the winter during ice and snow cover, Marsh Lake becomes hypoxic with low dissolved oxygen levels. The low winter dissolved oxygen levels are a significant stressor on fish in Marsh Lake. The Pomme de Terre River may provide dissolved oxygen refugia for fish in Marsh Lake during winter. Winter fish kills occurred historically in Marsh Lake prior to impoundment (Moyle 1941). There have not been significant fish kills in Marsh Lake since one winter in the early 1990's when large numbers of common carp were killed (Chris Domeier, DNR Fisheries, Ortonville, MN, personal communication December 2010).

Chlorophyll a concentration is a measure of active green plant pigment that indicates the biomass of algae in fresh water. Chlorophyll a is essential to photosynthesis and is the primary basis for primary production by algae. Primary production in most lake ecosystems is dominated by planktonic algae. Benthic (attached to the bottom) algae, submersed and emergent aquatic plants and terrestrial vegetation also contribute organic matter to lake ecosystems. High concentrations of chlorophyll a in lake water indicates high planktonic algal biomass and eutrophic conditions. Many lakes and rivers in the Minnesota River Basin are eutrophic with high concentrations of chlorophyll a due to phosphorous loading from non-point sources.

The combination of algae, non-living particulate organic matter, dissolved solids and inorganic suspended sediment reduces light penetration into the water and primary production by submersed aquatic plants and benthic algae.

James and Barko (1995) reported that algal biomass in Marsh Lake represented by chlorophyll a concentrations appeared to be affected by high wind velocities during both 1991 and 1992. Chlorophyll a concentrations increased substantially (i.e., > 50 ug/L) during high winds in September of both years, coinciding with concomitant increases in total phosphorus (P) concentrations in the water column. In contrast, chlorophyll a concentrations were lower, less than 50 ug/L during the calmer summer months of both years.

Available Corps of Engineers water quality monitoring records for Marsh Lake documented chlorophyll a concentrations (Figure 2-14) ranging from approximately 0.015 to 0.1 mg/l (15 to 100 ug/l) during summer conditions in 2000 through 2003. Most of the measured chlorophyll a concentrations in Marsh Lake during that time were within the 25th to 75th percentile range for lakes in the Western Corn Belt Plains ecoregion (Berry and German 1999).

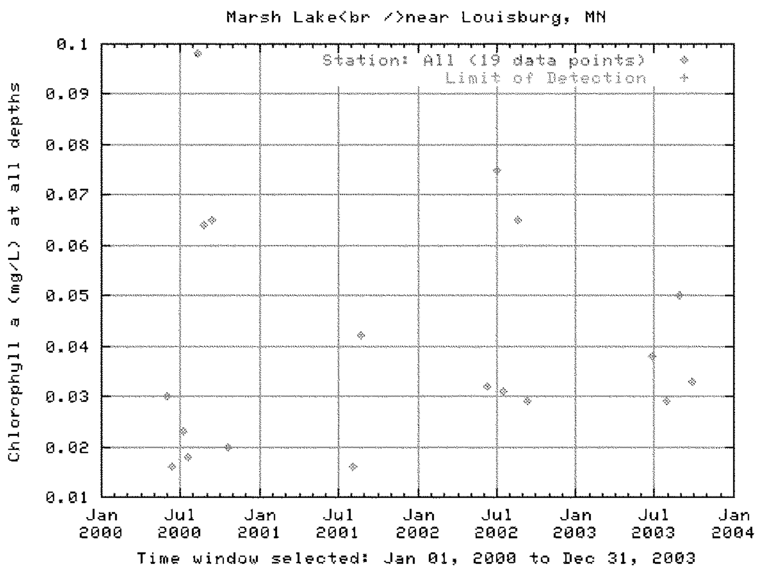


Figure 2-14. Chlorophyll a concentrations in Marsh Lake during the summers of 2000 through 2003. U.S. Army Corps of Engineers water quality monitoring data.

2.7 Historic and Cultural Resources

Previous cultural resources investigations at Marsh Lake include a 1993 survey of Corps fee title and leased lands at Marsh Lake Dam (Ollendorf and Mooers 1994a), a 1993 survey of one potential bank protection area on the north side of Marsh Lake (Ollendorf and Mooers 1994b), a 1998 survey of flowage easement lands along the south side of Marsh Lake between Marsh Lake Dam and the Louisburg Grade Road (Kolb et al. 1999), and a 1999 survey of Marsh Lake flowage easement lands between Louisburg Grade Road and Highway 75 Dam (Harrison 2000).

Minnesota Department of Natural Resources (DNR) archeologists conducted cultural resources surveys of small areas of DNR-administered lands (Marsh Lake Wild Management Area) surrounding Marsh Lake in 1996 and 2002 to 2008 (Emerson and Magner 2002:71-73; 2003:33-36; 2004:107-110; 2005:33-35; Magner et al. 2007:94-97; Magner and Allan 2008:133-138; Skaar 1997).

In 2008, Minnesota Department of Natural Resources archeologists conducted a Phase I cultural resources survey of areas specifically connected with the proposed Marsh Lake ecosystem restoration project along the pre-dam Pomme de Terre River channel both above and below the Marsh Lake dam embankment, at three proposed cutoff dike locations above the dam embankment; and at six potential lakeshore and island shoreline reaches where bank protection was proposed (Magner 2008). The proposed bank protection measures have since been dropped from the ecosystem restoration project due to natural armoring of the shorelines with rocks and cobbles that have eroded out of the soils in these areas.

Known cultural resources sites at Marsh Lake include the Marsh Lake Dam itself (SW-APT-003), as well as two prehistoric archeological sites (21LP33, 21BS67) and one prehistoric and historic archeological site (21BS35) between Marsh Lake Dam and the Louisburg Grade Road, and six prehistoric archeological sites (21BS41, 21BS43, 21BS44, 21BS45, 21BS46, 21LP36), one prehistoric and historic archeological site (21BS47), and two historic archeological sites (21BS42 and Area J Granite Quarry) between the Louisburg Grade Road and the Highway 75 Dam upstream. Sites 21BS41, 21BS42, 21BS43, 21BS44, 21BS45, and 21BS46 have been determined not eligible to the National Register of Historic Places (Minnesota SHPO letter dated January 16, 2002). Sites 21LP33, 21LP36, 21BS47, 21BS67 and the Area J Granite Quarry need further testing and research to determine their National Register eligibility.

Marsh Lake Dam (SW-APT-003) was determined individually eligible to the National Register of Historic Places in 1994 as part of the Lac qui Parle Flood Control Project, a flood control and water conservation system consisting of the Lac qui Parle Dam, the Marsh Lake Dam, and the Chippewa River Diversion. The Lac qui Parle Project was constructed as a Works Progress Administration (WPA) project under the sponsorship of the State of Minnesota beginning in 1936. It was one of the most extensive work projects of its kind undertaken by the State and the largest flood control project at the time of construction. Marsh Lake Dam is eligible for inclusion on the National Register under Criterion A for its association as a WPA project of the Federal Relief Programs following the Great Depression of 1929. Marsh Lake Dam consists of three contributing structures and one contributing object: the 1939 dam and embankment with a concrete fixed-crest main spillway and a grouted-riprap auxiliary spillway, two 1939 concrete stage recorder houses on the downstream side of the northeast embankment and the upstream side of the southwest embankment, and a rock with a plaque describing the intentions of the entire Lac qui Parle Flood Control Project. Marsh Lake Dam retains its integrity of original location, design, setting, materials, workmanship, feeling and association. While the Corps has added a metal structure to the upstream side of the northeast embankment in the 1970s and made emergency repairs to the grouted riprap overflow spillway in 1999, these minor repairs do not impact on the integrity of the structure.

2.8 Natural Resources

2.8.1 Climate

The climate is continental, with cold dry winters and warm wet summers. Average annual precipitation is 24 to 26 inches with two thirds normally falling in the five months from May through September. Average annual runoff is estimated at 1-2 inches. Average monthly temperatures recorded at Madison range from 12.40 F in Jan., to 68.80 F in July.

2.8.2 Land Use and Land Cover

Land use in the study area is primarily agricultural use and state-owned wildlife management area. Land cover within the study area is primarily emergent wetland vegetation, open water, agricultural cropland, pasture and hay, grassland, woody wetlands and deciduous forest (Figure 2-15, Table 2-3). The emergent wetland vegetation is largely single-species stands of reed canary grass (Phalaris arundinacea) and cattail (Typhus spp.) except in the upper end of Marsh Lake west of the Louisburg Grade Road.

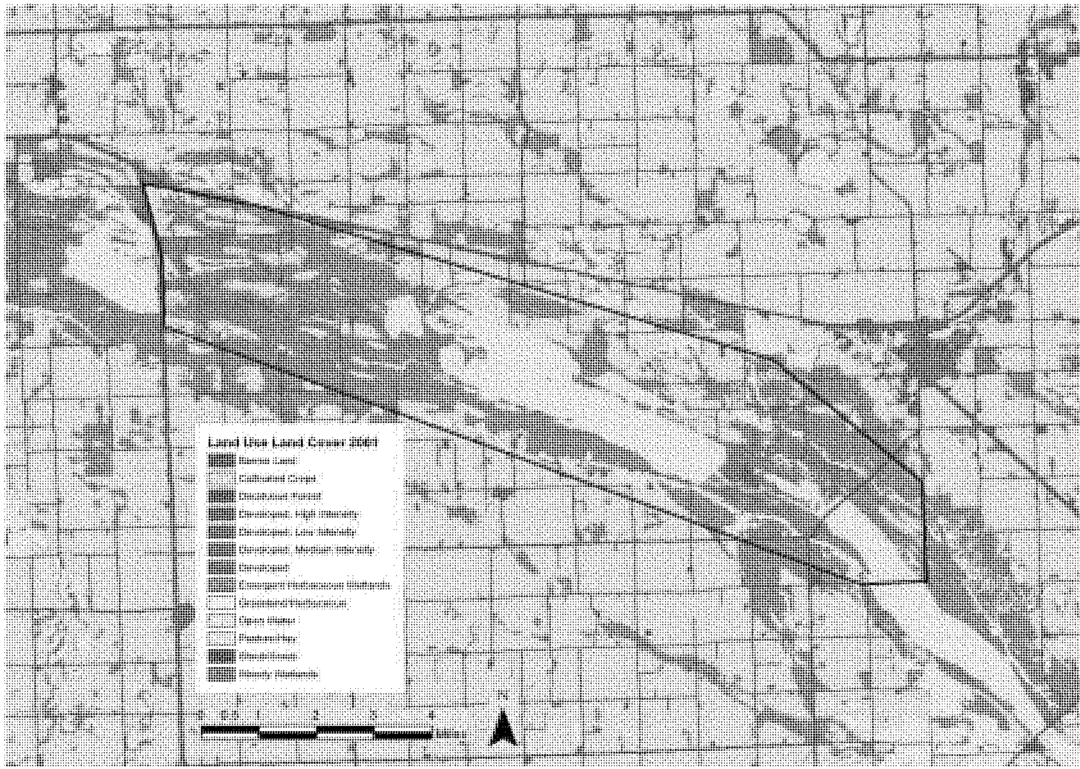


Figure 2 -15. Land cover and land use in the Marsh Lake project area (Minnesota DNR 2001 data). Dark line is the study area boundary.

Table 2-3. Land use and land cover classes within the Marsh Lake study area.

Acres	Land Use/Land Cover Class
5584	Open Water
475	Developed, Open Space
22	Developed, Low Intensity
6	Developed, Medium Intensity
82	Barren Land
217	Deciduous Forest
636	Grassland/Herbaceous
1891	Pasture/Hay
4288	Cultivated Crops
1325	Woody Wetlands
12391	Emergent Herbaceous Wetlands

2.8.3 Marsh Lake Ecosystem State

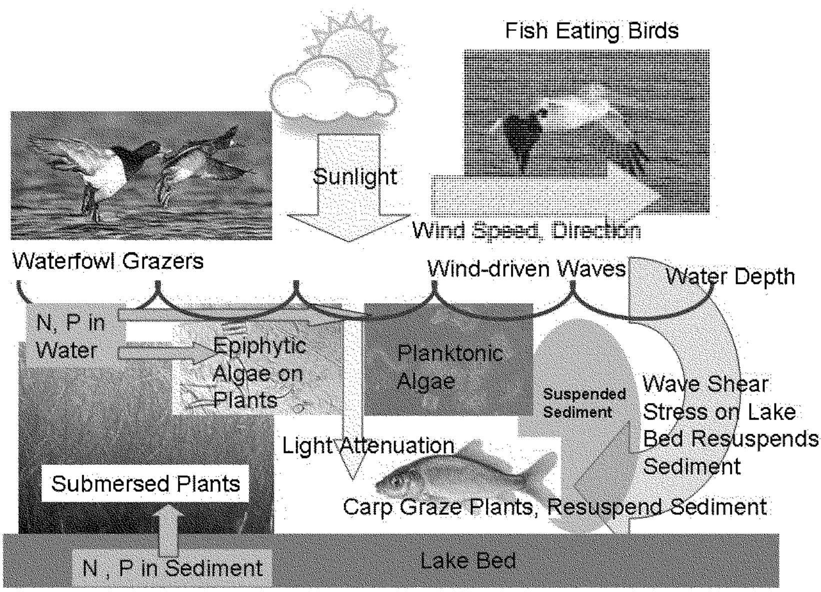


Figure 2-16. Conceptual model of the Marsh Lake ecosystem.

Shallow freshwater lakes are complex ecosystems. The ecosystem state of shallow lakes can shift from vegetated with clearer water and a mixed fish community to a turbid un-vegetated state dominated by blue-green algae blooms and bottom-feeding fish (Scheffer, 1998).

Figure 2-16 is an illustrative conceptual model of the Marsh Lake ecosystem. In a clear-water, vegetated state in the lake (on left in Figure 2-16), submersed aquatic plants dominate, providing food for migratory waterfowl, sheltering zooplankton and supporting a diverse fish community. The clearer water conditions and a diverse fish community support fish eating birds that rely on sight to prey on fish. White pelicans nest on islands in Marsh Lake where they are protected from predators and they forage widely for fish.

With increased loading of nutrients (nitrogen, phosphorus; N and P at left in the conceptual model), excessive algae grows on the leaves of submersed aquatic plants and limits their growth. Increased nutrient loading also supports planktonic algae blooms that limit light penetration into the water and further reduce submersed aquatic plants. As submersed aquatic plants become sparse, they no longer suppress wave action, allowing wind-generated waves to resuspend bottom sediment, further reducing light penetration into the water. Common carp thrive in turbid lakes and further reduce submersed aquatic plants by grazing and resuspending sediment. The turbid ecosystem state can persist for many years.

Drivers that can shift the ecosystem state back to the clear water vegetated condition include lower lake levels, reduced sediment loading, reduced nutrient loading, reduced wind fetch, sediment resuspension, and reduced carp populations.

Further explanation of historic, existing and forecasted future ecosystem conditions in Marsh Lake are provided in the sections that follow.

2.8.4 Historic and Recent Conditions in Marsh Lake

Immediately after construction of the Marsh Lake Dam, Marsh Lake had good habitat with extensive stands of submersed and emergent aquatic vegetation (Moyle 1941), but the aquatic and riparian ecosystems have degraded over the last 68 years.

Today Marsh Lake is a shallow, turbid environment (about 3,000 of 5,000 acres are less than 3 feet deep). Because the Marsh Lake Dam has a fixed crest and is not operable, the continuous minimum water surface has disrupted natural flooding and drying cycles. As a result, emergent aquatic plants that require exposed mudflat conditions to germinate from seed have declined in the lake. Reduced stands of emergent plants have increased the wind fetch. Wind induced wave action and non-native carp resuspend sediments, blocking sunlight and reducing opportunity for submersed aquatic plant growth (Figure 2-16). Wave action has eroded the shoreline, islands and points where emergent plants used to grow.

Aquatic plants and many other life forms in floodplain rivers like the Minnesota River are adapted to characteristic annual changes in flow and water levels (Junk et al. 1989, Bayley 1995).

2.8.5 Aquatic Vegetation

Aquatic plants are important components of the river ecosystem. Aquatic plants provide food and habitat for macroinvertebrates, fish and wildlife. They are a major source of primary production in the river system. Epiphytic algae grow on aquatic plants, providing another important source of primary production. Aquatic plants provide food for furbearers and food and habitat for macroinvertebrates, which in turn provide food for fish and birds. Aquatic plants cycle nutrients between the sediment and the water. Aquatic plants remove suspended sediment from the water, anchor substrate, attenuate wave action and reduce sediment resuspension. Aquatic plants remove nitrogen from the water and promote denitrification (conversion of nitrate and nitrite to nitrogen gas). Aquatic plants inhibit growth of planktonic algae, resulting in clearer water that favors sight-feeding fishes. Aquatic plants form patches of different habitat types needed by many fish and wildlife species. Aquatic plants provide a major source of food for migrating waterfowl. Aquatic plants contribute to the scenic beauty of the river.

Perennial Emergent Aquatic Plants

Perennial emergent aquatic plants like arrowhead, bulrush, cattail, and rice cutgrass can grow vegetatively for years from their root systems. Extended periods of high water, grazing by muskrats and waterfowl, ice and wind-driven wave action reduce the abundance of perennial emergent aquatic plants over time. In years with low summer water levels, perennial emergent aquatic plants have opportunity to germinate from seed in dewatered mud flats. The new plants grow to full size over the course of a couple growing seasons. Extensive stands of emergent aquatic plants are re-established and can persist for years.

Prior to impoundment, the Marsh Lake area was a frequently inundated and dewatered low floodplain with perennial smartweed (*Polygonum* sp.), reed canary grass (*Phalaris arundinacea*) and slough grass (*Spartina pectinata*). Following impoundment in 1937, in 1941 the emergent perennial plants around Marsh Lake included river bulrush (*Scirpus fluviatalis*), common cattail (*Typha latifolia*), narrow-leafed cattail (*Typha angustifolia*), wild millet (*Echinochloa crusgalli*), bur reed (*Sparganium urycarpum*), slough grass (*Spartina pectinata*), softstem bulrush (*Scirpus validus*), and giant reed grass (*Phragmites australis*) (Moyle 1941).

Historic aerial photography was interpreted by the Minnesota DNR to quantify the extent of emergent aquatic vegetation in Marsh Lake. The 1988-1989 droughts caused low water levels in Marsh Lake that enabled emergent aquatic plants to germinate in the dewatered areas of the lake bed. In 1991 there were 1574 acres of emergent aquatic plants around the periphery of Marsh Lake (Figure 2-17). After a number of years of stable and higher water levels and the flood year of 1998 when Marsh Lake water levels were very high, the extent of emergent aquatic plants on Marsh Lake declined to 1032 acres (Figure 2-18).

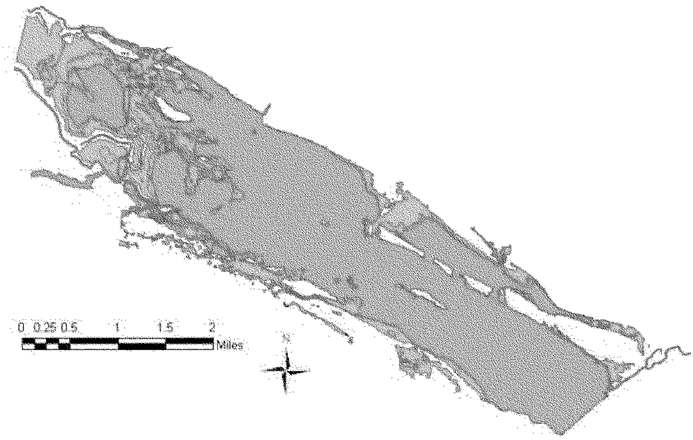


Figure 2-17. Emergent aquatic vegetation covering 1571 acres in Marsh Lake in 1991, interpreted from aerial photography by the Minnesota DNR.

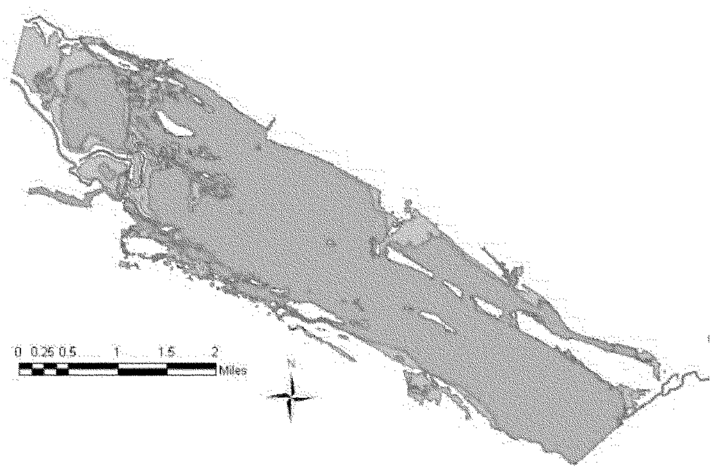


Figure 2-18. Emergent aquatic vegetation in Marsh Lake covering 1032 acres in 1999, interpreted from aerial photography by the Minnesota DNR.

Years of maintaining a minimum water level on Marsh Lake has caused emergent perennial aquatic plants to decline in extent, diversity and abundance. Today, the perennial emergent plant community is dominated by a narrow band of hybrid cattail with occasional river bulrush with a band of dense reed canary grass on the landward side around the periphery of the lake.

Submersed Aquatic Plants

Submersed aquatic plants require underwater light to thrive. In years of extended high water and turbid conditions, the submersed aquatic plants in Marsh Lake are nearly absent. In rare years with lower spring and summer water levels and little wind-driven sediment resuspension, more light reaches the bottom and submersed aquatic plants have the opportunity to grow.

Low summer water levels dewater sand bars and mud flats, oxidizing and consolidating sediment. Upon reflooding, the consolidated sediment is more resistant to resuspension by wind-driven wave action. Decomposition of organic matter in dewatered sediment releases nutrients for plant growth.

Submersed aquatic plants in Marsh Lake have varied markedly in abundance from one year to another. Following impoundment, Moyle (1941) reported that in 1941, approximately 10 percent of the area of Marsh Lake had submersed aquatic plants. Sago pondweed (*Stuckenia pectinatus*) and coontail (*Ceratophyllum demersum*) were the most common species. In 1991, Marsh Lake had near-complete coverage with sago pondweed, but it was not present in 1992 (James and Barko 1995).

Sago pondweed is the dominant submersed plant (Table 2-4) in Marsh Lake due primarily to its ability to withstand a wide range of turbidity levels compared to other submersed macrophytes (Stuckey 1971). Sago pondweed produces tubers that are an important food source for migrating diving ducks and geese in the fall. Sago pondweed frequency of occurrence in Marsh Lake can vary markedly. In 2002, 72.2% of the stations sampled (n=277) recorded sago pondweed whereas in 2007, only 11.5% (n=165) recorded sago pondweed (Table 2-4).

When sago pondweed is abundant (e.g. 2002, Fig. 2-19), plant distribution is throughout the entire lake even in the deepest water zones. In years of limited abundance (e.g. 2007, Fig. 2-20), plant distribution is restricted to protected bays and shallow water zones on Marsh Lake. James and Barko (1995) documented the positive role sago pondweed can have on reducing sediment resuspension by dampening wave action on Marsh Lake.

Aside from sago pondweed, submersed aquatic plant diversity is extremely low and other species were limited to a few individual plants found only in the most protected bays and shallow water zones on Marsh Lake (Table 2-2, Fig. 2-20). The primary factors limiting overall submersed aquatic plant abundance in Marsh Lake appears to be high spring and summer water levels, abnormal timing and magnitude of water level fluctuations, wind-driven wave-induced sediment resuspension limiting underwater light and grazing by common carp.

A bioenergetics plant growth model (POTAM) for sago pondweed was used to simulate existing and with-project conditions for submersed aquatic plant growth in Marsh Lake (Appendix J). Using information on wind speed, wind direction, water depth, experiments to determine the critical shear stress for Marsh Lake sediment resuspension, and application of the POTAM plant growth model indicate that current conditions in Marsh Lake do not allow the persistence of sago pondweed. The availability of underwater light is the primary limiting factor.

Table 2-4. Frequency of occurrence of submersed aquatic plants in Marsh Lake, 1962-2007. MN-DNR Wildlife Lake Habitat and Game Lake Survey Reports.

Species	Frequency of Occurrence %				
	1962	1968	2002	2004	2007
Sago pondweed	46.0	37.0	72.2	22.4	11.5
Coontail (*Ceratophyllum demersum*)	4.0	1.0	3.6	0.6	1.2
Greater bladderwort (*Utricularia vulgaris*)					0.6
Leafy pondweed (*Potamogeton foliosus*)	9.0				
Illinois pondweed (*P. illinoensis*)	2.0				
Narrowleaf pondweed (*P. strictifolius*)	2.0				
Narrowleaf pondweed group (*P. NL spp.*)			0.7		0.6

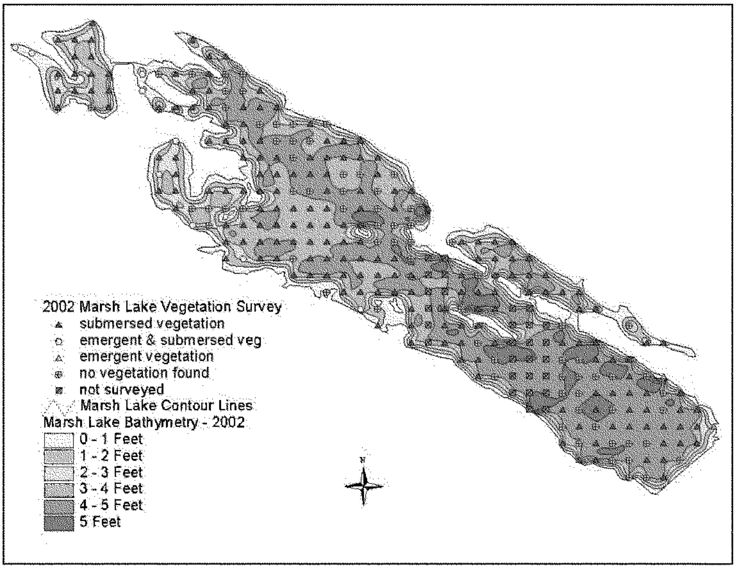


Figure 2-19. Distribution of submersed vegetation in Marsh Lake, 2002. Minnesota DNR survey data.

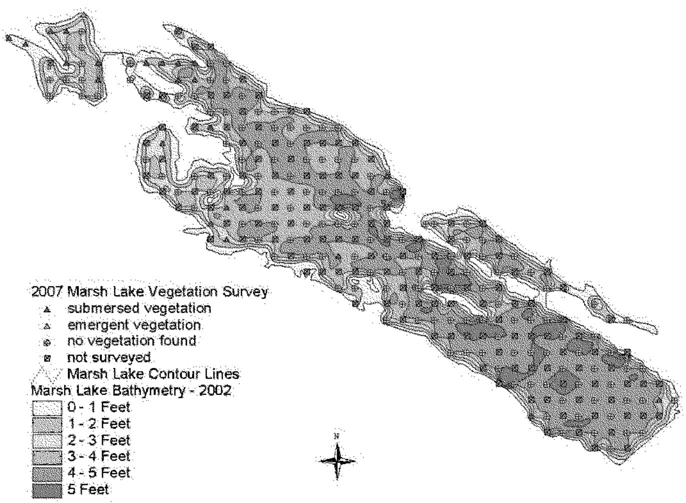


Figure 2-20. Distribution of submersed vegetation in Marsh Lake, 2007. Minnesota DNR survey data.

Annual Emergent Aquatic Plants

Annual emergent aquatic plants also germinate from seed in mudflats dewatered during low water periods during the growing season. These plants grow rapidly, provide food and shelter for wildlife, and then die at the end of the growing season. The senescent plants provide an abundance of organic matter for zooplankton, which in turn provide food for small fish.

Prior to impoundment, the frequently inundated low floodplain that became Marsh Lake supported extensive areas of "rank herbaceous vegetation" of annual emergent aquatic plants, including smartweed (*Polygonum* spp.), nut grass (*Cyperus* spp.) and sticktight (*Bidens* spp.) (Moyle 1941). Following impoundment in 1937, Moyle (1941) reported that because of little fluctuation in water levels, the margin of Marsh Lake was taken over with mostly perennial emergent aquatic plants.

Today, sparse annual emergent aquatic plants occur around the edges of Marsh Lake. Their extent and abundance varies with water level fluctuations during the growing season.

2.8.6 Fish Community

The Minnesota River and its tributaries support a diverse native fish community. The DNR found 25 fish species during a 2006 survey of Marsh Lake, using gill nets and trap nets for adult fish, and fine mesh trap nets for young-of-year and small fish (Minnesota DNR 2006).

Common carp are the most abundant fish in Marsh Lake, dominating the community by both numbers and biomass (Tables 2-5 and 2-6). Common carp were brought from Europe to the U.S. in 1831 and invaded the Minnesota River by the late 1800s. Carp have fluctuated in abundance between 62 per 24-hour gill net set in 2000 to a low of 3.7 per gill net in 1997. The 2006 catch was 28.5 carp per gill net. These catch rates for carp are considerably higher than in other similar lakes in Minnesota.

Table 2-5. Results of DNR 2006 gill net survey on Marsh Lake

Fish Species	No. Fish 6 Gill Net Sets	Community Composition (%) by Number	Total Weight (lbs) 6 Gill Net Sets	Community Composition (%) by Weight
Bigmouth Buffalo	33	6.8	47	5.1
Black Bullhead	39	8.0	9	1.0
Black Crappie	27	5.5	7	0.8
Brown Bullhead	24	4.9	16	1.7
Channel Catfish	15	3.1	40	4.3
Common Carp	171	35.0	629	67.9
Freshwater Drum	16	3.3	16	1.7
Northern Pike	30	6.1	30	3.2
Shorthead Redhorse	9	1.8	9	1.0
Walleye	62	12.7	62	6.7
White Bass	38	7.8	38	4.1
White Sucker	19	3.9	19	2.0
Yellow Bullhead	1	0.2	1	0.1
Yellow Perch	4	0.8	4	0.4

Table 2-6. Results of DNR 2006 trap net survey on Marsh Lake.

Fish Species	No. Fish 15 Trap Net Sets	Community Composition (%) by Number	Total Weight (lbs) 15 Trap Net Sets	Community Composition (%) by Weight
Bigmouth Buffalo	3	0.8	17.6	2.0
Black Bullhead	31	7.8	3.3	0.4
Black Crappie	35	8.8	14.8	1.7
Bluegill	1	0.3	0.1	0.0
Brown Bullhead	8	2.0	6.8	0.8
Channel Catfish	2	0.5	2.2	0.3
Common Carp	96	24.2	619.5	71.9
Common Shiner	1	0.3	0.1	0.0
Freshwater Drum	103	26.0	37.6	4.4
Green Sunfish	1	0.3	0.1	0.0
Northern Pike	22	5.6	80.6	9.3
Orangespotted Sunfish	1	0.3	0.1	0.0
Quillback	1	0.3	0.4	0.0
Shorthead Redhorse	14	3.5	29.2	3.4
Walleye	20	5.1	18.3	2.1
White Bass	43	10.9	20.4	2.4
White Sucker	3	0.8	6.1	0.7
Yellow Bullhead	8	2.0	3.3	0.4
Yellow Perch	3	0.8	1.7	0.2

Northern pike are moderately abundant, similar to other shallow lakes in Minnesota. Some natural reproduction of northern pike in Marsh Lake was evident with young-of-year in the fine mesh trap samples. Northern pike spawn in the upstream end of Marsh Lake, in the extensive areas of emergent aquatic plants above the Louisburg Grade Road.

One and two-year-old walleye constituted most of the walleye catch. Previous stocking studies using oxytetracycline tracer indicated that downstream migration of walleyes stocked in Big Stone Lake contribute substantially (50 percent of the 2006 year class) to the walleye population in Marsh Lake. Other game fish are low in abundance.

Yellow perch grow fast in Marsh Lake, reaching quality size for the sport fishery (10 to 11 inches long) in three years. They have been historically abundant in Marsh Lake but were not in 2006.

Habitat Connectivity and Fish Migrations

Lac qui Parle provides good habitat for native walleyes, northern pike, white bass and white suckers but the Marsh Lake Dam prevents their access to prime spawning areas in the Pomme de Terre River (walleyes, white bass, white suckers) and in the upper end of Marsh Lake (northern pike) (Figure 2-21). The dam also prevents the transport of native mussel glochidia (small larval stage mussels that temporarily parasitize fish by attaching to their gills) from Lac qui Parle to the Pomme de Terre River.

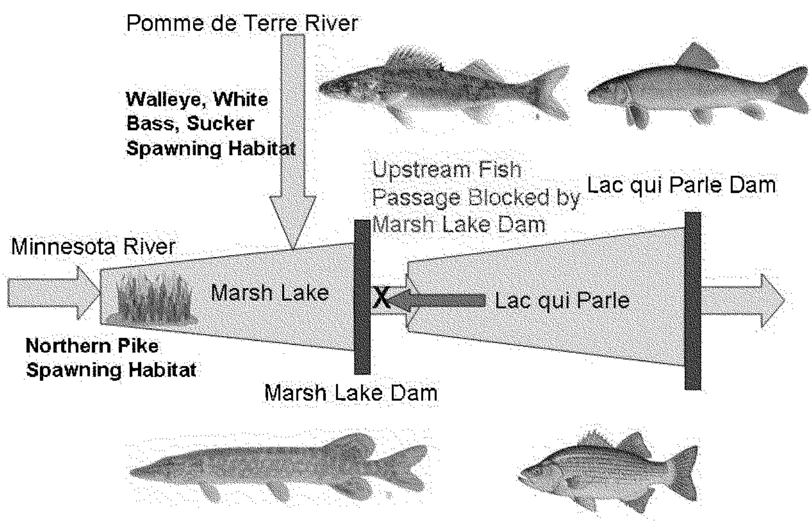


Figure 2-21. Conceptual model of blocked fish migration routes from Lac qui Parle into Marsh Lake and the Pomme de Terre River.

Fish persist in Marsh Lake despite hypoxic (low dissolved oxygen concentration < 5 mg/l) conditions in winter and high turbidity and high water temperatures in summer. In winters with little or no inflow from the Minnesota River and with ice and snow cover preventing photosynthesis by algae, inflowing Pomme de Terre River water may provide oxygen refugia for carp. Winterkill of fish historically occurred in Marsh Lake (Moyle 1941). Winter dissolved oxygen monitoring by the DNR has found periods of hypoxia, but the last winter fish kill in Marsh Lake occurred in the early 1990s when dead carp were found (Chris Dohmeier, DNR Fisheries, Ortonville MN, personal communication, December 2010). The winter aquatic habitat conditions created by the diversion of the Pomme de Terre River into Marsh Lake favors non-native carp over native northern pike. Northern pike are more tolerant of hypoxic conditions than are carp.

2.8.7 Macroinvertebrates

The benthic macroinvertebrate community in Marsh Lake in 1990 was dominated by chironomid and ceratopogonid midge larvae with some mayflies, caddisflies and dragonflies (Montz 1990). Fingernail mussels (*Sphaeriidae*) are an important food for fish and waterfowl. They were not present in Marsh Lake in 1990. A 1989 survey of the Minnesota River Basin (Zischke et al. 1990) found that the macroinvertebrate community in the Minnesota River downstream of Lac qui Parle dam was dominated by amphipods. Very few insects were present.

The Pomme de Terre River supports a diverse macroinvertebrate community. Invertebrates were collected by the Minnesota DNR from the Pomme de Terre River over the period of June 25-July 1, 1991 using a kick-net. Samples were not quantified, but invertebrates were identified and presence noted. Fingernail clams (order Pelecypoda) were found at all stations and were the only invertebrates found at Station 6, located 32.8 miles from the mouth. In contrast, sampling of stations 2 and 7 found the presence of six different insect orders. Insect larvae were most abundant in areas with coarser substrates such as gravel or rubble. Additional species collected from the river outside of specific sampling stations included a snail from the genus *Ferrissia*, the leech *Placobdella parasitcia*, and a stonefly from the family Pteronarcidae. The most abundant insect larvae were mayflies (order Ephemeroptera.)

2.8.8 Mussels

The Minnesota DNR conducted mussel surveys of Marsh Lake and the Pomme de Terre River in 2007 and 2010. A detailed report of the DNR mussel surveys is provided in Appendix Q. Only one live mussel was found in Marsh Lake, a pink heelsplitter (*Potamilus alatus*), a species adapted to living in soft substrate.

A diverse and abundant mussel community was found in the lower Pomme de Terre River. The river mussel community there is dominated by threeridge (Amblema plicata). The survey results suggest the river has a regionally significant assemblage of freshwater mussels as compared to the Minnesota River Basin as a whole. Abundance of mussels in the Pomme de Terre River, in terms of qualitative search catch per unit effort (CPUE, mussels/hour), was substantially higher than in the Minnesota River main stem or elsewhere in the entire Minnesota River Basin. The Pomme de Terre River also has regionally significant populations of elktoe (*Alasmidonta marginata* - MN Threatened), black sandshell (*Ligumia recta* - MN Special Concern) (Figure 2-22), three ridge (*Amblema plicata*), and Wabash pigtoe (*Fusconaia flava*), as these are the largest populations of these species in the entire Minnesota River system, based on statewide mussel survey data collected to date. The highest densities of mussels were found at stations in the diverted reach of the lower Pomme de Terre River just upstream of Marsh Lake.

No invasive zebra mussels (*Dreissena polymorpha*) have been found the project area.

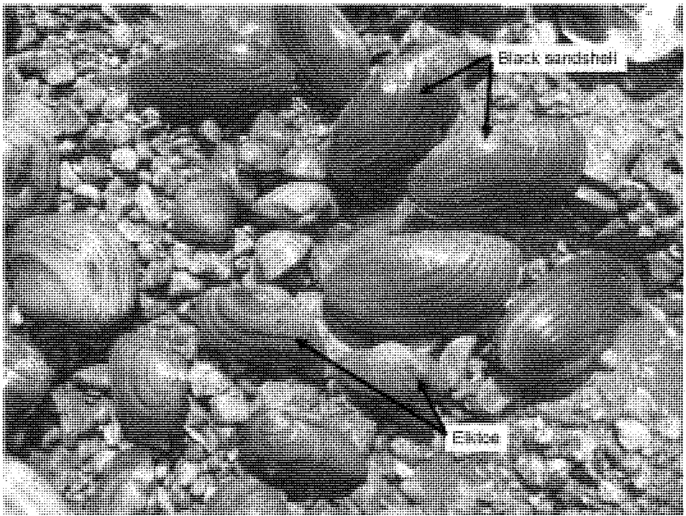


Figure 2-22. State-listed mussels from the lower Pomme de Terre River, August 2007. Minnesota DNR photo.

Table 2-7. Mussels found in Marsh Lake and the Lower Pomme de Terre River during an August 2007 survey. Minnesota DNR data.

				Lower Pomme de Terre River						
				Diversion Reach		Upstream of Diversion Reach				
Species	Common Name	MN Listing Status	Marsh Lake	2136	2137	3042	3034	2138	2135	3035
Alasmidonta marginata	**elktoe**	**threatened**						2	2	
Amblema plicata	threeridge	unclassified		461	153	63	46	7	14	1
Fusconaia flava	Wabash pigtoe	unclassified		26	14	17	1	2	7	
Lampsilis cardium	plain pocketbook	unclassified		39	49	147	76	25	20	3
Lampsilis siliquoidea	fat mucket	unclassified			52	3	30	7	15	1
Lasmigona complanata	white heelsplitter	unclassified		4	8	2	2	1	5	1
Leptodea fragilis	fragile papershell	unclassified		5	5	5	2	8	4	1
Ligumia recta	**black sandshell**	**special concern**		9	4	28	9	5	13	
Potamilus alatus	pink heelsplitter	unclassified	1	9	4	4	6	7	9	
Pyganodon grandis	giant floater	unclassified		2				1	1	
Quadrula quadrula	mapleleaf	unclassified						1		
Strophitus undulatus	creeper	unclassified		1	1		6	1	1	1
Truncilla truncata	deertoe	unclassified		53	41	23	9	104	9	2
Total number live mussels			1	609	331	292	187	171	100	10
Number of sites sampled			3	1	1	1	1	1	1	1
Avg. CPUE (mussels/hr)			0.7	365.4	220.7	116.8	83.1	60.4	44.4	6.7

2.8.9 Wildlife

The Marsh Lake project area lies within the 32,990-acre Lac qui Parle Wildlife Management Area, managed by the Minnesota DNR. The adjacent 11,521-acre Big Stone National Wildlife Refuge is upstream and is managed by the U.S. Fish and Wildlife Service. The Nature Conservancy owns two preserves adjacent to the Lac qui Parle Wildlife Management Area totaling 2,436 acres. Together these three natural areas provide over 46,000 acres of protected wildlife habitats in the upper Minnesota River valley.

The habitat is a diverse mixture of shallow lakes, prairie potholes, cattail marshes, native prairie grasslands - some of the largest remaining in west-central Minnesota – restored grasslands, old field habitats, floodplain forests, rock outcrops, and cropland. This habitat diversity supports a rich assemblage of animal species.

<u>Birds</u>

The Audubon Society has recognized the Lac qui Parle – Marsh Lake – Bigstone Refuge area as an Important Bird Area of national significance. The upper Minnesota River valley is located in one of the most heavily traveled duck migration corridors in the United States (Bellrose 1976). Most migrants originate from Alberta, Manitoba, North Dakota, and Minnesota, but others come from subarctic and arctic-nesting grounds in western Canada and Alaska.

<u>Waterfowl (Geese)</u> – the Lac qui Parle Wildlife Management Area has the largest concentration of migrating Canada geese in the state. In November, as many as 120,000 to 150,000 Canada geese use the State Game Refuge at one time, accounting for over 800,000 goose-use days (September – December; MN-DNR, unpublished data). Canada goose use of Marsh Lake peaks at around 5,000 to 10,000 during this time period. Approximately 65% of these geese are from the Eastern Prairie Population, which nests near the southwestern shore of Hudson Bay and traditionally wintered on or near Swan Lake National Wildlife Refuge in Missouri. The Canada geese are accompanied by smaller flocks of snow, cackling, and white-fronted geese. Ross's geese are uncommon visitors.

<u>Waterfowl (Ducks)</u> – Blue-winged teal, mallard, and wood duck are the most abundant breeding ducks. The ruddy duck is the most common nesting diving duck, but secure nests sites are limited due to fluctuating water levels. Blue-winged teal, green-winged teal, mallard,

and wood duck are the most common puddle ducks early in the fall migration. American wigeon, gadwall, northern shoveler, and pintail are common but tend to be less abundant.

Mallard numbers build as the fall progresses reaching a peak in mid-November while other puddle duck numbers decline. Counts of peak mallard numbers normally range between 40,000 to 80,000+ between the Lac qui Parle Wildlife Management Area and Big Stone National Wildlife Refuge. This large concentration of migratory waterfowl lasts for a week or two and is not related to food resources within the Big Stone National Wildlife Refuge, Marsh or Lac qui Parle Lakes, but is due to the security from predators that these large water bodies provide. The large flocks of migratory waterfowl feed on waste grain in surrounding agricultural fields and roost at night on the lakes. This fact is further borne out by weekly waterfowl surveys on Marsh Lake held in October 2006 and 2007, which documented mallard and teal numbers averaging <500 birds each. However, on an adjacent moist-soil unit with abundant native aquatic plant food resources, puddle ducks numbered in the thousands (David Trauba, personal communication).

Diving duck-use, primarily ring-necked duck, redhead, and lesser scaup, is very low on Marsh and Lac qui Parle Lakes. It is well documented that heavy diving duck-use is related to the amount of aquatic food resources available. Marsh Lake in its present form, with its turbid waters and correspondingly low plant diversity and abundance, is not attractive diving duck habitat.

<u>Shorebirds</u> – Thousands of shorebirds migrate through the Marsh Lake area in the spring and late summer. The Big Stone National Wildlife Refuge with its managed pools is a focal point and in 2004 over 100,000 individual shorebirds were counted within the boundaries of the Lac qui Parle – Big Stone Important Bird Area. Marsh Lake with its stable water regime receives limited shorebird use.

Colonial Waterbirds – Marsh Lake contains the largest breeding colony of American pelicans in North America. In 2006, waterbirds nested on 5 islands and one peninsula in Marsh Lake. The following numbers were estimated from aerial photography (DiMatteo and Wollenberg, unpublished data):

American pelicans: 19,396 breeding pairs
Double-crested cormorant: 1,550 breeding pairs
Ring-billed gulls: 4,083 breeding pairs
Great egret: 212 breeding pairs

Forster's terns, black crowned night herons, great blue herons, and occasionally cattle egrets are also associated with these nesting islands.

Bird Species Diversity – Over 250 species of birds are recorded on an annual basis within the upper Minnesota River valley. Grassland birds associated with our native prairie tracts include: northern harrier, short-eared owl, greater prairie chicken (restoration), sharp-tailed grouse, upland sandpiper, marbled godwit, eastern kingbird, clay-colored sparrow, savannah sparrow, Henslow's sparrow, Le Conte's sparrow, bobolink, western meadowlark, loggerhead shrike, Brewer's blackbird, and the exotic ring-necked pheasant. Neotropical songbirds such as warblers and vireos use the floodplain forests. American bitterns, sora, red-winged and yellow-headed blackbirds are found along the cattail zone on Marsh Lake; western grebes previously nested on Marsh Lake but have been absent in recent years. As many as 50 bald eagles use the area during the spring and fall migration and 5-8 pairs nest here. Golden eagles are uncommon.

Mammals

Fifty-two mammal species are known to or probably occur within the upper Minnesota River valley. Mule deer, pronghorn antelope, and elk are rare visitors today but were present prior to European settlement. Sightings of moose, which are mostly transient animals, occur almost every year. The large herds of bison are gone.

White-tailed deer, eastern cottontail, white-tailed jackrabbit, gray and fox squirrels are common and hunted during authorized seasons. Beaver, muskrat, mink, raccoon, short and longtail weasels, badger, striped skunk, red fox, coyote, and opossum are common furbearers; river otters were successfully reintroduced and are now common.

Because small mammals are inconspicuous, their distribution and abundance is difficult to assess. The most common small mammals include: white-footed mouse, deer mouse, short-tailed shrew, meadow jumping mouse, meadow vole, prairie vole, masked shrew, and redbacked vole.

Reptiles and Amphibians

Rocky outcropping and other dry areas provide habitat for reptiles, while in the wetlands a variety of amphibians can be found. The following is a list of reptiles and amphibians that may be observed in the upper Minnesota River valley spring through fall:

Spiny soft-shell turtle
Snapping turtle
Western painted turtle
Prairie Skink
Red-bellied snake
Red-sided garter snake
Plains garter snake
Bull snake
Western hog-nosed snake
Fox snake
Mudpuppy
Eastern tiger salamander
American toad
Great Plains toad
Canadian toad
Cope's gray tree frog
Northern leopard frog
Western chorus frog

Butterflies and Insects

Several rare butterfly species are known to be inhabitants of our native prairie plant communities that still exist in the upper Minnesota River valley. These species include: Dakota skipper, poweshiek skipper, arogos skipper, pawnee skipper, and the regal fritillary, one of the state's showiest butterflies. One record exists of the ottoe skipper in Big Stone County.

There is much less information about moths than about butterflies, but there are also prairie-restricted moths, perhaps a large number. Examples are the under wing moths *Catocala abbreviatella* and *C. whitneyi*, and the small *Noctuid schinia lucens*. All of these feed on leadplant as larvae. Other important orders that are known to contribute elsewhere to a distinctive prairie fauna are beetles (*Coleoptera*) and the leafhoppers (*Homoptera*). The grasshoppers and crickets (*Orthoptera*) may also have a few highly restricted representatives in prairie remnants.

Open sedge meadow wetlands that have not suffered much disturbance also support some restricted butterflies (and probably members of other orders) such as the mulberry wing, the broad-winged skipper, and the dion skipper. However, there are no records from the vicinity.

Aquatic habitats are prominent features of the upper Minnesota River valley. Major aquatic insect orders should be well represented, including stoneflies (*Plecotpera*), mayflies (*Ephemeroptera*), caddisflies (*Trichoptera*), and dragonflies (*Odonata*). Other orders that contribute significantly to the aquatic and shoreline fauna are beetles, flies (*Diptera*), and true bugs (*Hemiptera*). The highly disturbed character of aquatic habitats probably means that there are no rare or narrow habitat specialists present. There are several small calcareous seepage fens present in the river valley that might harbor some rare specialists.

2.8.10 Endangered and Threatened Species

No Federally-listed threatened or endangered species occur in the Marsh Lake project area. Bald eagles nest and feed in the area. They are no longer listed as a Federal endangered species, but they are still protected.

The bald eagle is a state-listed threatened species. The Dakota skipper is a rare prairie butterfly that is a candidate for state listing that occurs in the project area. The Pomme de Terre River has regionally significant populations of elktoe mussels (*Alasmidonta marginata* - MN Threatened) and black sandshell (*Ligumia recta* - MN Special Concern).

2.8.11 Contaminants, Hazardous, Toxic and Radioactive Waste

A Phase 1 HTRW Assessment has been conducted in areas potentially affected by construction of a project. The Phase 1 HTRW is a stand-alone document included in Appendix F. No known issues related to HTRW are present at the site.

2.9 Social and Economic Conditions

2.9.1 Land Use

Big Stone County covers approximately 528 square miles (338,281 acres). According to the Minnesota database of land use statistics (January 2000), Big Stone County's largest single land use category is cultivated land with 74.6 percent of the total, followed by hay/pasture/grassland at 11.6 percent. Lac qui Parle County covers approximately 778 square miles (498,324 acres). Lac qui Parle County's largest single land use category was also cultivated land with 82.5 percent of the total, followed by hay/pasture/grassland at 9.9 percent. Swift County covers approximately 752 square miles (481,439 acres). Swift County's largest single land use category was also cultivated land with 83.4 percent of the total, followed by hay/pasture/grassland at 8.7 percent. Table 2-8 provides total land use and cover statistics by county.

Table 2 - 8. Land use and cover statistics by County

Land use/cover categories	Big Stone	Lac qui Parle	Swift
Urban and rural development	1.4%	1.7%	1.6%
Cultivated land	74.6	82.5	83.4
Hay/pasture/grassland	11.6	9.9	8.7
Brush land	0.2	0.2	0.3
Forested	2.7	2.7	2.8
Water	5.7	1.7	1.4
Bog/marsh/fen	3.7	1.3	1.7
Mining	0.1	0.1	0.1

Source: Minnesota Land Management Information Center – Database of land use statistics, January 2000

2.9.2 Transportation

Major highways in Big Stone County include U.S. Highway 12, which goes east-west through the County connecting Ortonville to Minneapolis/St. Paul located 175 miles to the east, and U.S. Highway 75 which goes north-south through the County connecting Ortonville to Fargo/Moorhead located 110 miles to the north. Major highways in Lac qui Parle County include U.S. Highway 212, which goes east-west through the County, and U.S. Highway 75 which goes north-south through the County connecting Madison to Fargo/Moorhead located approximately 137 miles to the north. Major highways in Swift County include U.S. Highway 12, which goes primarily east-west through the County connecting Benson to Minneapolis/St. Paul located 110 miles to the east, and U.S. Highway 59 which goes north-south through the County.

There are two active rail lines in Big Stone County. Burlington Northern/Santa Fe (BNSF) operates a class two rail line that runs along the northern edge of the County, along the northern side of State Highway 28 through the communities of Johnson, Graceville, Barry and

Beardsley. The other rail line in Big Stone County is operated by Twin Cities & Western Railroad Co. (TC&W). The TC&W line is a class three line that runs parallel to State Highway 7 on the southern edge of the County to Ortonville. It runs through the communities of Correll, Odessa, and Ortonville. Madison, the county seat for Lac qui Parle County, is served weekly by BNSF. It is 38 miles to the main line. There are two active rail lines in Swift County, the BNSF and TC&W. The BNSF runs through the communities of Benson, Clontarf, Danvers, DeGraff, Holloway, Kerkoven, and Murdock. The city of Appleton is served by the TC&W.

Big Stone County has one airport located in Ortonville. It has a 3,418 foot-long lighted and paved runway. Lac Qui Parle County has airports located in Madison and Dawson. The airport in Madison has a 3,300 foot-long lighted and paved runway. The Dawson airport closed on October 30, 1990. Swift County has airports located in Appleton, Benson, and Murdock. The airport in Appleton has a 3,500 foot-long paved runway. The airport in Benson has a 4,000 foot-long paved runway. The airport in Murdock has a 3,415 foot-long turf runway and is closed in the winter.

2.9.3 Regional Economy

The top industries in Minnesota are tourism, agriculture, computers and services, healthcare and medical equipment, forest and forestry products and printing and publishing (www.state.mn.us). Within the study are, livestock and crop farming are the mainstays of the local economy (www.appletonmn.com). Table 2-9 represents the major non-agricultural industries in the area.

Table 2 - 9 Employment By Industry-Swift County	Number of employed
Government	1,009
Trade, Transportation and Utilities	782
Manufacturing	623
Professional and Business Services	400
Education and Health Services	303
Leisure and Hospitality	204
Financial Activities	163
Other Services	111
Information	38

Source (www.appletonmn.com) - 2008 data

2.9.4 Employment

Big Stone County's labor force totaled 2,859 in March 2005, with an unemployment rate of 6.6 percent, compared to 5.0 percent (unadjusted) for the State of Minnesota and 5.4 percent (unadjusted) for the United States. Lac qui Parle County's labor force totaled 4,273 in March 2005, with an unemployment rate of 5.1 percent. Swift County's labor force totaled 5,525 in March 2005, with an unemployment rate of 6.1 percent

2.9.5 Income

Median household income is the mid-point at which one half of the households earn more and one half earn less. According to information from the U.S. Census Bureau, the 1999 median household money income for Big Stone County was $30,721, for Lac qui Parle County it was $32,626, and for Swift County it was $34,820. This compares to $47,111 for the State of Minnesota and $41,994 for the United States.

Per capita income represents total income divided by the population to derive a per person income estimate. According to 2000 census figures, per capita income (1999 dollars) for Big Stone County was $15,708, for Lac qui Parle County it was $17,399, and for Swift County it was $16,360. This compares to $23,198 for the State of Minnesota and $21,587 for the United States.

Families and persons are classified as below poverty level if their total family or unrelated individual income was less than the poverty threshold specified for the applicable family size, age of householder, and number of children under 18 present. The Census Bureau uses the Federal government's official poverty definition. For example, the poverty threshold in 1999 for a family of four with two children less than 18 years of age was $16,895.

According to 2000 census figures, in Big Stone County, 12.0 percent of the population was below the poverty level, for Lac qui Parle County it was 8.5 percent, and for Swift County it was 8.4 percent. This compares to the state average of 7.9 and the national average of 12.4 percent.

2.9.6 Demography

Table 2-10 describes the population of the study area.

Table 2-10 Demographics of Study Area	Study Area	U.S.
Total population	35,979	304,059,724
White persons, percent, 2008 (a)	95.19%	79.80%
Black persons, percent, 2008 (a)	1.34%	12.80%
American Indian and Alaska Native persons, percent, 2008 (a)	0.85%	1.00%
Asian persons, percent, 2008 (a)	0.83%	4.50%
Native Hawaiian and Other Pacific Islander, percent, 2008 (a)	0.61%	0.20%
Persons reporting two or more races, percent, 2008	1.25%	1.70%
Persons of Hispanic or Latino origin, percent, 2008 (b)	3.01%	15.40%
White persons not Hispanic, percent, 2008	92.43%	65.60%
Female persons, percent, 2008	48.37%	50.70%

Source - US Census Bureau State and County Quick Facts 2008

Population totals for the study area are presented in table 2-11.

Table 2-11 Study Area Population

	Swift	Lac Qui Parle	Big Stone	Chippewa	Study Area Total
2000	11956	8067	5820	13088	38931
2008	11035	7165	5365	12414	35979
% Change	-7.70%	-11.18%	-7.82%	-5.15%	-7.58%

Source - US Census Bureau State and County Quick Facts 2008, Census 2000

It is estimated that the four-county area lost between .1% and 9.9% of its population from 1990 to 2000 (US census- Population Change and Distribution).

2.9.7 Education

Among persons 25 years and over, 79.0 percent of Big Stone County's population has achieved high school or higher educational attainment, for Lac qui Parle County it was 80.8 percent, and for Swift County it was 80.4 percent. This compares to 87.9 percent for the State of Minnesota, and 80.4 percent for the United States (U.S. Census Bureau 2000).

Of Big Stone County's population, approximately 11.4 percent of the adults 25 years and over possess bachelor's degrees or higher, for Lac qui Parle County it was 13.0 percent, and for Swift County it was 14.0 percent. This compares with 27.4 percent for the State of Minnesota and 24.4 percent for the United States (U.S. Census Bureau 2000).

While there is no institution of post-secondary education in Big Stone, Lac qui Parle, or Swift Counties, Minnesota West Community and Technical College is located 26 miles away from Madison in Canby, Minnesota. Ridgewater Community and Technical College is located 30 miles away from Benson with facilities in Hutchinson and Willmar, Minnesota. The University of Minnesota, Morris is an undergraduate liberal arts campus of the University of Minnesota and is located 25 miles away from Benson and 50 miles from Ortonville.

2.9.8 Housing

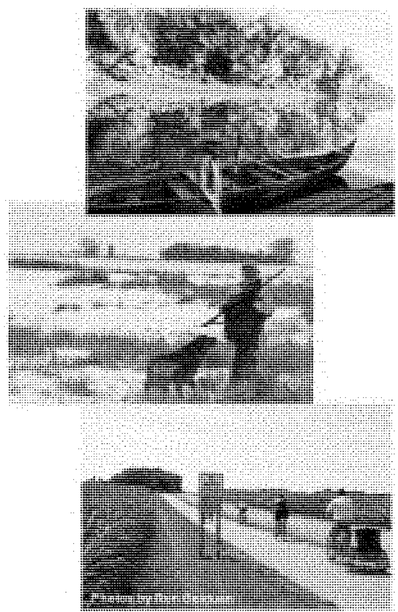
According to 2000 census figures, there are a total of 3,171 housing units in Big Stone County. There were 2,022 owner-occupied (63.8 percent), 355 renter-occupied (11.2 percent), and 794 (25.0 percent) vacant housing units. The vacancy rate for single-family housing units was 5.3% and 20.4% for rental housing units. The median value of owner-occupied housing units is $41,900. Median rent totaled $231 and the median mortgage is $580.

According to 2000 census figures, there are a total of 3,774 housing units in Lac qui Parle County. There were 2,683 owner-occupied (71.1 percent), 633 renter-occupied (16.8 percent), and 458 (12.1 percent) vacant housing units. The vacancy rate for single-family housing units was 3.6% and 9.7% for rental housing units. The median value of owner-occupied housing units is $43,100. Median rent totaled $348 and the median mortgage is $572.

According to 2000 census figures, there are a total of 4,821 housing units in Swift County. There were 3,353 owner-occupied (69.6 percent), 1,000 renter-occupied (20.7 percent), and 468 (9.7 percent) vacant housing units. The vacancy rate for single-family housing units was 2.6% and 13.1% for rental housing units. The median value of owner-occupied housing units is $58,200. Median rent totaled $362 and the median mortgage is $632.

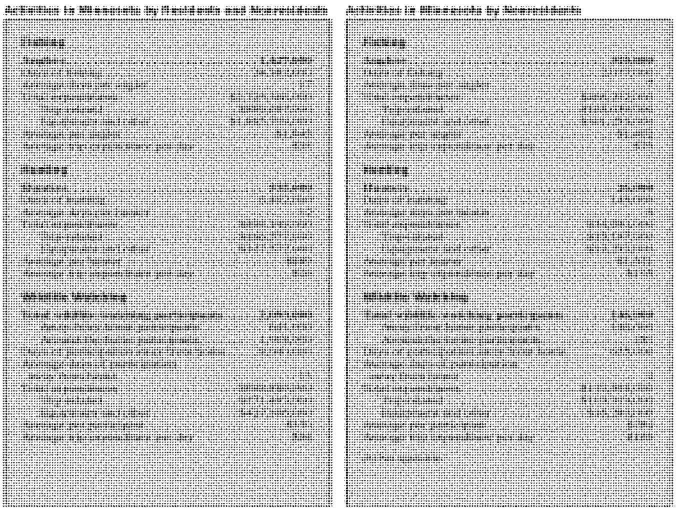
2.9.9 Recreation

The Minnesota River corridor is rich in history, culture, natural and scenic beauty offering exceptional recreational opportunities for outdoor enthusiasts of all ages. The Marsh Lake project area supports a variety of recreational activities including canoeing, kayaking, fishing, hunting, wildlife viewing, boating, bicycling and cross-country skiing.



Improving the area around Marsh Lake improves the recreational connectivity of the upper portion of the Minnesota River corridor—from Big Stone Lake near Ortonville to Marsh Lake to Lac qui Parle Reservoir near Montevideo. This corridor is approximately 47 miles long and includes Lac qui Parle, Swift, Big Stone, and Chippewa Counties with an approximate combined population of 35,979 *(US Census Bureau, 2008 estimates)*.

There are 12 municipalities in the project region of which the cities of Ortonville and Appleton are the largest, about 5,000 people. Tourism dollars provide an important contribution to the local economy but regional recreation opportunities also help to sustain a high quality of life to residents in the area.



2006 National Survey of Fishing, Hunting and Wildlife Associated Recreation – Minnesota. U.S. Fish & Wildlife Service

Fishing

Most angling on Marsh Lake occurs through the ice in winter and in the spring. Anglers primarily fish for walleye and northern pike. Winter creel surveys were conducted by the Minnesota DNR in 2002 and 2004. Anglers and spear-fishermen (for northern pike) spent an estimated 2112 hours in the winter of 2002 to catch 531 fish of which most were yellow perch and walleye and 22 were northern pike. During the winter of 2004, anglers spent an estimated 1681 hours to catch 229 walleye and yellow perch. No northern pike were observed caught.

Lac qui Parle supports a popular sport fishery, primarily for walleyes and northern pike. Angler effort has varied over the years, mostly due to weather, lake level and fish abundance (Table 2-12).

Table 2-12. Lac qui Parle Sport Fishing (Minnesota DNR data).

Date	Open water angler hours (one SE)	Ice angler hours (one SE)[c]	Number of fish harvested (one SE)	Pounds of fish harvested (two SE)	Non-fishing recreation hours (one SE)[b]
May 13-Oct. 24, 1989	100,734 (7,869)[a]		21,302 (1,060)[a]	31,617 (1,822)	2,932
Dec. 9, 1989-Feb. 15, 1990	165 (74)[a]	38,814	2,226	5,872	
May 14-Oct. 31, 1994	75,285 (16,543)[a]		18,016 (7,059)[a]	25,649	
Dec. 1, 1994-Feb. 19, 1995		73,618 (17,356)[a]	16,706 (6,752)[a]	23,621	
May 13-Oct. 31, 1995	81,787 (8,684)		22,449 (4,157)	40,819	58 (35)
Dec. 1, 1995-Feb. 18, 1996		40,054 (6,962)	3,813 (948)	5,210	
May 12-Oct. 31, 2001	59,871 (5,999)		9,070 (1,062)	18,025	1,951 (399)
Dec. 1, 2001-Feb. 17, 2002		28,493 (3,391)	1,951 (319)	3,551	
May 10-Oct. 31, 2003	56,565 (5,615)		6,577 (717)	11,026	1,742 (332)
Dec. 1, 2003-Feb. 15, 2004		30,872 (5,385)	2,451 (691)	4,471	

[a]Measure of variability was calculated as two standard errors.
[b]Non-fishing recreation activities consisted of swimming, water-skiing, canoeing, pleasure boating, sailing, jet skiing, and waterfowl hunting.
[c]Ice fishing estimates include spearers.

Hunting

Minnesota wildlife management areas are used for public hunting, trapping, fishing, wildlife viewing and other activities compatible with wildlife and fish management. Hunting has always accounted for the largest share of public use on the Lac qui Parle Wildlife Management Area, but the area is also used for fishing, wildlife viewing, cooperative farming, cooperative grazing and haying, rough fish harvest and environmental education.

The Lac qui Parle area is considered a “major destination point” for wildlife related activities due to the area’s large public land-base and proximity to the Twin Cities metropolitan area. Beyond Canada goose hunting, the economic impact of wildlife related recreation has not been measured for the Lac qui Parle Wildlife Management Area specifically.

The U.S. Fish and Wildlife Service (2005) estimated Waterfowl Production Areas in Minnesota generated $19.8 million in spending by all visitors in 2004. The Morris Wetland Management District, which includes counties in the Upper Minnesota River Valley, generated the most spending by waterfowl hunters in the state at $8.7 million. In 2001, Minnesota ranked first in the nation for the number of waterfowl hunters, generating an economic impact of $132.5 million for the state of Minnesota (Henderson 2005). In 2006, 87.5 million U.S. residents 16 years old and older participated in wildlife-related recreation. During that year, 30.0 million people fished, 12.5 million hunted, and 71.1 million participated in wildlife viewing spending an estimated $122.3 billion on their activities (U.S. Department of Interior 2006).

Hunters pursue various wildlife species at Lac qui Parle. Foremost are Canada geese, waterfowl, deer, and pheasants. The pursuit of rabbits, squirrels, turkeys, and furbearers also provides important recreational opportunity.

Visitor-use records spanning an entire hunting season do not exist, except for Canada goose hunters. The visitor information for ducks and pheasants is for opening day only on the Lac qui Parle Wildlife Management Area. Deer hunting estimates are taken from MN-DNR 2006 Deer Harvest Report.

Canada Goose Hunting - The Lac qui Parle Wildlife Management Area lies within Minnesota's West Central Goose Zone. For a five-year period (1990-1994) all goose hunters in the West Central Goose Zone were required to purchase a permit before hunting. A postseason survey of randomly selected permit holders was then conducted to determine Canada goose harvest, hunter activity, and success. In addition, hunters using state blinds at the Lac qui Parle Refuge are required to register in person to use a blind, and report their success at the completion of their hunt. Based on the West Central Goose Zone survey in 1994, it was determined that 11,121 persons spent a total of 60,581 hunter-use days pursuing Canada geese. The state blinds accounted for 4,271 hunters-use days – an average of 142 hunters/day. Of the state blind hunters, 603 were under 18 years of age. Most hunters (39.1%) were from the southern portion of Minnesota, with 22.5% from the Twin Cities and 10.7% from the West Central Goose Zone.

The total economic value of the goose hunt was estimated at $2.2 million in 1985 with over half the goose hunter expenditures ($1.2 million) being made in the local area (Hiller & Kelly 1987). Private land hunters paid nearly $410,000 to property owners for hunting privileges that same year. It is important to note that the above figures are based on an estimate of 5,446 hunters or 30,546 goose-hunting days in the Lac qui Parle Zone. From the 1990-94 West Central Goose Zone permit, it was determined that 7,500-10,600 hunters spend 30,500-43,200 goose-hunting days in the Lac qui Parle Goose Zone. Based on permit data, it appears the 1987 report, although the numbers are substantial, underestimated the economic impact of the goose hunt.

Duck Hunting - Marsh Lake is the focal point for duck hunting, especially the western half (motorized zone). From 1997-2006, the opening day car count has averaged 183 vehicles or an estimated 371 hunters. The peak opening day car count occurred in 1998 with 262 vehicles for an estimated 547 hunters. Hunting pressure remains heavy on the weekends throughout the waterfowl season, but is light to moderate during the week. Eighty percent of the opening day duck hunters were from the Twin Cities metropolitan area.

Pheasant Hunting - From 1998-2007, the opening day car count has averaged 166 vehicles for an estimated 352 hunters. The peak opening day car count occurred in 2006 with 254 vehicles for an estimated 519 hunters. Sixty percent of the opening day pheasant hunters were from the Twin Cities metropolitan area.

Deer Hunting - The Lac qui Parle Wildlife Management Area lies within Permit Area 433, which is 402 square miles in size. In 2006, 2,526 firearm hunters were estimated to have hunted in Permit Area 433 for 6.3 hunters per square mile. Although not specifically measured, wildlife personnel believe much of this pressure occurred between the Lac qui Parle Wildlife Management Area and Big Stone National Wildlife Refuge. This hunter density estimate is slightly higher than the statewide average of 5.6 hunters per square mile. Hunter density estimates do not exist for archery or muzzleloader hunters but we do know archery and muzzleloader hunters harvested 108 and 229 deer, respectively, in 2006.

Trapping - Trappers are required to receive a trapping permit from the resident manager, and provide an annual harvest report. Fur prices are the driving force behind trapper numbers and for the past 3 years trapping permits have ranged from 7 to 15. This is down from an average of 26 trapping permits, 1965-75.

Wildlife Viewing - No estimate has been made for wildlife viewing visitation rates. These activities are year-round, dispersed, and very difficult to monitor. In 2006, an estimated 1.9 million Minnesota residents 16 years and older, or 48% of the total population, took part in wildlife-watching activities spending $698 million on equipment and trip related expenses within Minnesota (U.S. Department of Interior 2006).

The upper Minnesota River Valley is a popular destination for wildlife watchers because of the abundance and diversity of wildlife that can be seen. A number of specific sites provide wildlife viewing opportunities. The Lac qui Parle Management Area and the Marsh Lake Dam site are popular wildlife viewing areas located within the geographic scope of the study. Wetland and prairie species can be observed in the Lac qui Parle Wildlife Management Area. A diversity of migratory waterfowl can be observed in the fall. The Marsh Lake Dam is a popular spot for birdwatching.

There are other sites that provide wildlife viewing opportunities within the Minnesota River corridor in Big Stone, Swift, Lac qui Parle and Chippewa counties. The Minnesota River Valley Birding Trail maps existing roads, paths and bike trails to link 132 birding sites within the Minnesota River Watershed. Recommended routes and sites are mapped for birders to follow. A variety of wildlife including, prairie chickens, upland sandpipers, and marbled godwits can be observed at Plover Prairie, a 655 acre wet prairie owned by The Nature Conservancy. The 1,143 acre Chippewa Prairie is a mesic prairie. Some species that can be observed here include migrating flocks of geese, ducks, sandpipers, godwits and other shorebirds; upland sandpiper, short-earred owl, and marbled godwit.

Wildlife watching is one of the most popular activities at the Big Stone National Wildlife Refuge. Seventeen species of ducks and 23 species of shorebirds can be observed during spring and fall. Mallards, blue-winged teal, northern shoveler, and Canada geese can be seen. Shorebirds include least and semipalmated sandpipers, and lesser yellow legs. It is also home to a diversity of seasonal, resident wildlife including great-blue heron, common egrets, and several species of ducks. A population of reintroduced river otters can be observed. The refuge serves as an important wintering area for white-tailed deer. In 2006, an estimated 22,050 visits were for wildlife watching and 14,300 visits in 2007. Visits were lower in 2007 due to the fact the auto tour loop was closed, which is a primary facility that visitors use to view wildlife.

Boating

The boating resources are Big Stone Lake, Marsh Lake, and Lac qui Parle. The vast majority of the boating activity in the area is associated with hunting and angling. There are 5 boat accesses within the geographic scope of the project. A 2007 visitation estimate recorded by the Corps of Engineers for Boyd Landing on Marsh Lake was 1,800.

Canoeing

The Minnesota River is designated as a Canoe and Boating route between Ortonville and Fort Snelling. The Pomme de Terre River, tributary of the Minnesota River, is also a designated Canoe and Boating Route. The Department of Natural Resources publishes canoe maps with descriptions of river segments, location of public access points, campsites, rest areas, navigational features and river miles.

The Minnesota River, Marsh Lake and Lac qui Parle are located within the geographic scope of this project and are a segment of the designated canoe route. Approximately five miles of the Pomme de Terre Canoe Route is also within the geographic scope of this project. Within the geographic scope of the project there are five canoe accesses on the Minnesota River and Marsh Lake and one on the Pomme de Terre. There are no use estimates for canoeing.

Hiking/Bicycling Trails

While there are no existing bicycle trails within the geographic scope of the project, there are several existing bicycle trails within the Minnesota River Valley corridor in Big Stone, Lac qui Parle and Swift Counties. The Marsh Lake area holds the potential to be integrated into a broad regional network of existing natural areas, recreational opportunities, and educational amenities through links between present and future trail systems.

Nearby Natural Areas with Recreational Opportunities

- Big Stone National Wildlife Refuge
- Big Stone State Park
- Lac qui Parle WMA
- Lac qui Parle State Park
- Lac qui Parle County Park
- Plover Prairie Preserve
- Fort Renville State Historic Park
- Upper Sioux Agency State Park

Present (P) and Future (F) Trail Systems

- MN State Bike Trail System (P, F)
- MN River Canoe Trail (P)
- National Scenic Byways MN River Valley Auto Tour (P)
- Audubon Society MN River Valley Birding Trail (P)
- Appleton Community Bike Trail (P)
- Watchable Wildlife Sites (P)
- Historic/Cultural/Heritage Trail (F)

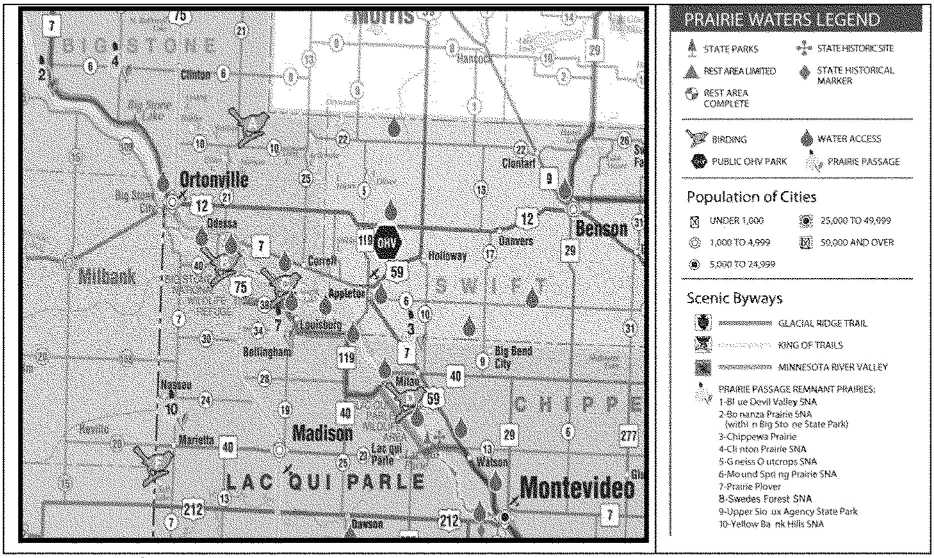


Figure 2-24. Official Trails and recreational opportunities in the project area.

Various area trails include:

<u>Milan to Milan Beach</u>

This 3 mile paved trail connects Milan Beach Resort on Lac qui Parle to Milan. It is envisioned that in the future, this segment would be part of the Minnesota River State Trail. There are no use statistics available for this trail.

<u>Appleton community trail system</u>

A 1.5 mile paved trail starts at Riverside Park and follows the banks of the mill pond, past the Appleton Athletic Field, hospital and nursing home and assisted living complex on the east end of town and connects back into town west to TH 7 via Reuss Avenue.

<u>County 32 adjacent to Lac qui Parle State Park</u>

Paved shoulders along County 32 connect the upper and lower portions of the park and can be used for biking.

Ortonville to Big Stone National Wildlife Refuge

A segment of the legislatively authorized Minnesota River State Trail was completed in the spring of 2008. This trail begins at the ouitlet of Big Stone Lake and travels through the southern part of Ortonville. It crosses the Minnesota River and exits the community in the southeastern corner. The trail parallels TH 75 until it connects with the Big Stone Refuge's 5.5 mile auto tour route.

There are no use estimates available for these bicycle trails, which are also used for hiking and skiing.

Cross-country Skiing

There are no groomed cross-country ski trails within the geographic scope of this project. However there are some trails within the Minnesota River Valley Corridor in Big Stone, Swift, and Lac qui Parle counties. Cross-country skiing is allowed in the Big Stone National Wildlife Refuge, although no trails are designated and managed for this use. Lac qui Parle State Park has 5 miles of cross-country ski trails.

Horseback Riding

Lac qui Parle State Park has 5 miles of horseback riding trails. Lac qui Parle County Park has horseback riding trails.

Snowmobiling

There are 460 miles of Grant In Aide snowmobile trails in Big Stone (122 miles), Lac qui Parle (184), and Swift (154) Counties. These trails are developed and maintained by local snowmobile clubs with the support of grants provided by Minnesota DNR through the local unit of government.

Off highway vehicle riding

The Appleton Off-Highway Vehicle Area provides recreation opportunities for off-highway vehicle riders. There are 10 miles of off-road vehicle trails, 15 miles of all terrain vehicle/off-highway motorcycle trails, 1.5 miles of off-highway motorcycle tracks and 3 enduro tracks.

Visiting Historic Sites

The history of the area also attracts recreationists to the area. Three significant sites visited are:

Fort Renville Site – location of Joseph Renville's fur trading post established in 1822 at a Wahpeton Dakota village

Lac qui Parle Mission State Historic Site

Big Stone County Museum -- displays from the area's past including a historic boat that traveled Big Stone Lake.

Recreation User Data

Use data for the recreational activities described above is limited. Several recreational facilities keep visitor data that serve as an indicator of the recreational activity in the area of the project. Data from Big Stone National Wildlife Refuge, Big Stone and Lac qui Parle state parks, and Corps of Engineers is displayed in Tables 2- 13 through 2-16.

Table 2-13. Lac qui Parle State Park attendance history.

Year	Total Attendance	Overnight Visits
2006	115,525	7,697
2005	111,835	7,678
2004	64,610	5,900
2003	69,426	5,477
2002	71,600	5,638
2001	48,786	2,998
2000	71,396	6,169
1999	68,965	5,908
1998	64,273	5,623
1997	71,942	3,765

Table 2-14. Big Stone Lake State Park attendance history

Year	Total Attendance	Overnight Visits
2006	53,663	3,266
2005	55707	3,531
2004	52,946	2,933
2003	52,444	2,870
2002	32,545	2,832
2001	29,079	3,188
2000	35,268	3,261
1999	36,559	3,730
1998	33,748	3,335
1997	28,581	3,432

Table 2-15. Big Stone National Wildlife Refuge user data

Activity	**2006 Visits**	**2007 Visits**
Hunting	3,000	2,700
Fishing	1,000	1,000
Wildlife observation	22,050	14,300
Photography	150	150
Environmental Education	270	180
Interpretive programs	800	1,350
Other	1,450	1,450

Table 2-16. Visitation data for the Marsh Lake Dam Recreation Area in 2009.

	Visitor Hours	Visitors
Sep 09	2037	1818
Aug 09	3231	2885
July 09	1144	1022
June 09	1529	1365
May 09	2334	2084
Apr 09	1115	995
Mar 09	930	578
Feb 09	205	183
Jan 09	626	559
Dec 08	666	595
Nov 08	1542	1049
Oct 08	2314	1574
FY Total	17673	14707

The Corps of Engineers maintains a recreation area at Marsh Lake Dam consisting of a parking area, picnic tables, rest rooms and a fishing platform.

Minnesota River State Trail

The Marsh Lake Dam is a vital connection for the alignment of the Minnesota River State Trail. The Minnesota River State Trail is a legislatively authorized state trail that will connect Big Stone Lake State Park to Le Sueur (Minnesota Statutes, Chapter 85.015, Subd. 22). The Draft Master Plan for the Minnesota River State Trail identifies a corridor that parallels Marsh Lake and the Lac qui Parle Management Area on the south, veering north at the location of the Marsh Lake Dam to connect into Appleton. The best alternative for crossing the river north into Appleton is the Marsh Lake Dam, due to the constraints of surrounding land ownership patterns and geography. In addition to providing an opportunity for a trail alignment, a crossing at this location also provides trail users access to the natural and cultural resources at this location.

2.10 Future Conditions Without an Ecosystem Restoration Project

The forecasted future conditions provide a baseline by which alternative plans are evaluated. The planning period of analysis for this project is 50 years and for the purposes of this report, the base year is defined as the year of proposed project completion, scheduled in 2014. Implementation of ecosystem improvements within the Marsh Lake project area by others was considered as a part of the future conditions, however, no known plans exist which would significantly alter future conditions from the assessment below.

2.10.1 Future Social and Economic Conditions

From 1990 to 2000, the population of the study area decreased by up to 10%. From 2000 to 2008 the study area lost 7.58% of its population. The most likely explanation for the overall decline in population in the study area is migration from rural to urban communities. This trend will presumably persist to some degree in the coming years as nearby metropolitan areas such as the Twin Cities and Fargo-Moorhead continue to draw rural populations.

2.10.2 Future Land Use and Land Cover

Terrestrial land use and vegetative cover on private land in the project area is expected to remain much in its present condition, dominated by annual row-crop agriculture, primarily corn and soybeans. The land use within the Minnesota River Watershed upstream of the project site is over 90% agricultural. The productivity of Minnesota agriculture is highly dependent on the hydrologic alteration that permits drainage of agricultural lands to maintain ideal agronomic growing conditions. While much of the drainage system within the basin was completed over the last 100 years, drainage improvements continue today. Professional experience within the basin and work with agriculture experts on the Minnesota River Integrated Watershed Study has shown that drainage improvements are on-going. These alterations have a substantial effect on the hydrology of the watershed and are often performed at a large scale._Future watershed change based on the amount of perennial cover on the landscape will depend on national Farm Bill policy. Provided the Conservation Reserve Program is reauthorized, and a market for perennial-based biomass emerges, it is possible the amount of perennial cover (e.g., native warm season grasses) on private land may increase. For the purposes of this Feasibility Study, however, existing land use is assumed to remain dominated by row crop agricultural.

That portion of the project area located on the state-owned Lac qui Parle Wildlife Management Area will continue to be managed to provide diverse wildlife habitats, healthy wildlife populations, and outdoor recreation. Land cover is diverse: open water, emergent wetlands, grassland, pasture and hayland, agricultural cropland, and deciduous floodplain forests. No major changes in land cover are anticipated.

As recommended by the Minnesota River Reconnaissance Study, a Minnesota River Integrated Watershed Study is currently being conducted by the Corps in conjunction with State and Federal study partners. This study will examine the root of problems related to hydrology, sediment transport, nutrient loading and flooding throughout the basin and recommend comprehensive solutions for implementation. The study is currently in its initial stages and it is not possible at this time to speculate how the outcome of this study may impact future watershed conditions. The Integrated Watershed Study is scheduled to be completed in 2015.

2.10.3 Future Hydrology

Climate change is expected to cause hotter, dryer summers and warmer winters in western Minnesota (Union of Concerned Scientists 2009). Climate change is forecast to result in shorter duration of ice cover, less snow, higher winter river discharge, more intense summer thunderstorm events, hotter summer temperatures, and generally more variable hydrology in the upper Minnesota River Basin. Inflows to Marsh Lake will probably decline and summer lake stages may be lower. Climate change is expected to bring about more extreme precipitation events, leading to larger floods and longer droughts.

2.10.4 Future Hydraulic Condition of Marsh Lake and Pomme de Terre River and Lac Qui Parle

The delta at the mouth of the Pomme de Terre River in Marsh Lake is expected to increase in area with time. Wind-driven sediment resuspension in Marsh Lake should maintain the same approximate geometry and volume of the lake, balanced between sediment inflows and export. The former channel of the Pomme de Terre River that was re-routed when the Marsh Lake Dam was constructed will probably accumulate sediment and rise slightly in elevation over time. Sediment from Marsh Lake will continue to accumulate in Lac qui Parle, primarily in the upper end of the lake.

The Marsh Lake Dam will continue to be operated over time as with passive discharge, in the same manner it is today. Recreational activity around the dam does pose a risk to public safety, as evidenced by a drowning death at the site in 1991.

The dam will continue to provide a conservation pool for boaters, which does provide a recreational benefit at the site. In its current condition, however, the dam provides little flood damage reduction benefit to downstream communities. Hydraulic modeling of the river shows that the dam itself is partially inundated with a 1% chance flood event (947.4'). The consequences of failure at Marsh Lake Dam are relatively minor as it lies above the Lac qui Parle Reservoir, which contains more storage than Marsh Lake. A flowage easement up to elevation 945 exists for the Lac qui Parle Reservoir, and there is no population below that elevation. Detailed modeling results are provided in Appendix J of this report.

2.10.5 Future Ecosystem State

Emergent aquatic plants have declined to a limited band of hybrid cattails, sparse river bulrush and dense reed canary grass on the periphery of Marsh Lake. This extent of emergent aquatic plants is expected to continue in the future, covering approximately 1032 acres as in 1999 (Figure 2-18 above).

In rare years when conditions allow, such as occurred in 1991, submersed aquatic vegetation can grow in Marsh Lake. In most years however, water levels and turbid conditions caused by wind-driven sediment resuspension and by carp will prevent growth of submersed aquatic plants. The abundant carp in Marsh Lake will also graze back submersed aquatic plants. The frequency of occurrence of submersed aquatic plants in Marsh Lake is expected to be less than 15 percent as was found in the 2007 survey (Table 2-7).

Biomass of the most abundant submersed aquatic plant, Sago pondweed, is expected to remain low and therefore existing and without-project future conditions are assumed to be equivalent. Application of a wind fetch model (Rohweder et al. 2008) and a bioenergetics plant growth model, POTAM for sago pondweed (Best and Boyd 2003) provided an estimate of existing and future without-project sago pondweed shoot and tuber biomass production in Marsh Lake (Appendix J, Table 2-17).

Table 2-17. Simulated production of sago pondweed in Marsh Lake under existing and without-project future conditions (existing and future-without assumed to be equivalent).

Depth Class (m)	Average Wind Fetch (m)	Area in Depth Class (acres)	Peak Biomass (lb/ac)		Lakewide Peak Biommass (Tons)	
			Shoots	Tubers	Shoots	Tubers
0.5 (0 - 0.75)	751	1364	1071	204	731	139
1 (0.75 - 1.25)	1371	2541	840	173	1067	220
1.5 (1.25 - 1.75)	1430	502	371	171	93	43
				Total	1891	401

Vegetation in the abandoned channel area of the Pomme de Terre River downstream of the Marsh Lake Dam is expected to shift toward flood-tolerant woody vegetation as sediment accumulates there, including sandbar willow, black willow, cottonwood and silver maple.

Conditions of the Lac qui Parle ecosystem are not expected to change in the future. It is assumed the Lac qui Parle pool is similar in ecosystem condition to that of Marsh Lake with high susceptibility to wind and wave driven sediment resuspension resulting in a turbid environment with low levels of submersed aquatic vegetation.

2.10.6 Future Water Quality

Climate change will probably result in less ice cover, better winter dissolved oxygen concentrations and warmer summer water temperatures. Continued row crop agriculture and further expansion of the agricultural drainage network in the watershed will cause the future hydrologic regime to become flashier with more rapid increases in tributary discharge during runoff events. Loadings of sediment and plant nutrients to Marsh Lake are expected to remain the same or increase.

If a change in the agricultural economy and associated land use shifts toward increased perennial cover crops, infiltration of water on the land would increase and loadings of sediment, nitrogen and phosphorus would be significantly reduced, leading to improved water quality conditions in the project area.

Without restoration, Marsh Lake is expected to continue to accumulate sediment that is later transported via the Minnesota River to Lac qui Parle Lake during wind-driven resuspension events. Low primary production will continue because of high turbidity and a lack of aquatic plants.

2.10.7 Future Fish Community

The expected future water quality conditions described above are conducive to fish communities dominated by non-native fish, primarily common carp and freshwater drum. The absence of submersed aquatic plants will continue to limit spawning success and juvenile growth of northern pike and other native fish. Low numbers of large predatory fish will allow non-native species, especially common carp, to remain abundant. In addition, the lack of sufficient resources from primary production and larger sized zooplankton will continue to limit the survival of young-of-year native fish.

Without restoration of the Pomme de Terre River and fish passage through Marsh Lake Dam, fish habitat will continue to be fragmented. Native fish from Lac qui Parle such as walleye and northern pike will continue to be excluded from the Pomme de Terre River and its high-quality spawning habitat. Likewise, fish from the Pomme de Terre River will continue to be excluded from the winter refugia in the Minnesota River and Lac qui Parle.

Overall, without restoration of the Marsh Lake ecosystem, the future fish community will consist primarily of non-game species that are expected to maintain or increase in abundance. However, conditions will continue to be less favorable for popular game fish species, and their abundance will stay the same or decline. The result will be a declining fishery resource that is unattractive and undesirable to users of the area.

2.10.8 Future Wildlife

Without restoration, Marsh Lake will continue to exist in its turbid water state. Emergent vegetation will be dominated by a narrow band of hybrid cattail with reed canary grass on the periphery. Submersed vegetation will consist of only one species, sago pondweed, and in most years be limited to a few plants (<15% frequency of occurrence) found in sheltered bays. Overall future aquatic vegetation in Marsh Lake will provide only limited food and cover for wildlife.

Waterfowl numbers are expected to remain low. In certain years field-feeding mallard and Canada goose numbers will be impressive, but their numbers are related to the security the lake provides for resting and not the waterfowl food present. Most species of waterfowl, especially diving ducks, will pass through quickly spending at most a day or two on the lake. This rapid turn-over in numbers is directly related to the lack of waterfowl foods, primarily sago pondweed, low species diversity in the perennial emergent zone and few annual emergent aquatic plants due to static water levels.

Colonial waterbird numbers and diversity are expected to remain stable. Long term population fluctuations are more related to region-wide environmental conditions, meta-population dynamics, and not conditions in the lake itself. American pelicans, cormorants, and gulls are attracted to Marsh Lake due to lack of human disturbance and the security of the nesting islands, not water quality. Western grebes previously nested on Marsh Lake but have been absent in recent years. Without restoration, it is doubtful western grebes will return to Marsh Lake.

Shorebird numbers are expected to remain very low. Shorebird numbers and food availability are directly related to the quantity and quality of available mud flat habitats. Climate change may result in hotter, dryer summers, lower lake stages and hence mud flats, but extreme precipitation events will most likely negate this potential benefit for shorebirds. Agricultural drainage is expected to continue in the watershed and will result in the hydrologic regime to become even flashier with increased episodic tributary inflows. Without restoration, mud flat conditions are expected to be rare and confined to only those years of extreme drought throughout the growing season.

Furbearer numbers are expected to remain similar with no major changes in species composition. Furbearer numbers fluctuate based on broad environmental conditions, disease, and in-lake water levels fluctuations. For example, successive years of stable water levels allow muskrat numbers to increase with a corresponding increase in mink numbers a few years later (predator prey relationship). Conversely, widely fluctuating water levels should result in a gradual decline in muskrat and hence mink numbers in the Marsh Lake basin. Climate change complicates these relationships but again no major population changes expected.

2.11 Planning Assumptions

Planning assumptions underlie the logic of the planning process. Although these states of nature and anticipated human activities are not certain, they are assumed to apply in the future:

1. The Lac qui Parle Flood Control Project (including the Marsh Lake Dam) will continue to be operated and maintained by the Corps of Engineers for the foreseeable future.

2. The hydrologic regime of the Minnesota and Pomme de Terre Rivers will remain within historic seasonal ranges of flow.

3. The Lac qui Parle Wildlife Management Area will continue to be maintained and managed by the DNR.

4. The beneficial uses of the Marsh Lake ecosystem (flood damage reduction, fish and wildlife management, recreation) will continue to provide benefit to the public.

5. The value of flood damage reduction to downstream urban and agricultural areas will continue or increase in the future.

6. Loss of habitat over time within the watershed will increase the value of Marsh Lake and Lac qui Parle as a protected area for wildlife.

7. The value of the project area for recreation and frequency of use is expected to be maintained over time.

3. Problems and Opportunities

One of the critical steps in the initial planning process is the identification of problems and opportunities associated within the geographic scope of the project area. Problem statements are concise characterizations of the broad issue that will be addressed with the project. Opportunity statements follow each problem and consist of an array of opportunities presented by the virtue of planning and construction activities occurring at the site of the problem. Opportunities can be directly related to solving the problem at hand, but can also be ancillary to the identified problem. From the list of opportunities, objectives for the project are drafted. The success of the project planning is determined by the fulfillment of the objectives through identified alternative measures (Sections 4-Section 6).

Because ecosystem restoration authority is the guiding authority for the Marsh Lake Ecosystem Restoration Project, objectives drafted for this study are primarily related to ecosystem outputs. As noted in the preceding Sections, construction of the Marsh Lake Dam in 1939 inundated natural floodplain habitats, increased reservoir fish and wildlife habitat and created new colonial water bird nesting habitat by creating islands. However, it also disrupted natural river functions and processes, affecting sediment movement and floodplain function, blocking fish movements, and reducing river and floodplain habitats. Natural flooding and drying cycles were disrupted, reducing emergent aquatic plants and associated fish and wildlife habitats found in the area prior to the impoundment. Taking the existing and forecasted future conditions into consideration, the following problems were identified:

- Degraded Marsh Lake Ecosystem State
- Low-Diversity Fish Community
- Degraded Pomme de Terre River Ecosystem State

Each problem is elaborated upon in the sections below.

3.1 Problem: Degraded Marsh Lake Ecosystem State

Marsh Lake has been subject to long-term degradation. Rapid delivery of water, sediment, and nutrients into the system due to land use changes in the watershed led to higher and faster fluctuations in water levels and degraded water quality. The current degraded ecosystem state is primarily influenced by the following stressors:

- Altered hydrologic regime
- Sediment loading
- Sediment resuspension
- Invasive species
- Loss of ecosystem connectivity

The sedimentation rate over the last 60 years has been estimated at approximately 60 acre-feet (97,000 cubic yards) per year from both the Minnesota and Pomme de Terre Rivers. The lake appears to have reached equilibrium with sediment loading and export to Lac qui Parle. Wind and wave action resuspends sediments that have accumulated in the reservoir. The suspended sediment blocks sunlight and limits the growth of aquatic plants, which affects the quality of fish and wildlife habitat. Much of the resuspended material and associated phosphorus passes downstream where it affects water quality and promotes algal growth in Lac qui Parle. Carp thrive in the lake, grazing on aquatic vegetation, resuspending sediment and further degrading habitat for other fish and wildlife.

The lack of aquatic plants has limited food available for migrating waterfowl. Over time, the lake has developed into a shallow, turbid unvegetated ecosystem state, and its habitat quality has declined.

After spring runoff, water levels remain relatively stable due to the dam's fixed-crest design. The lake is very shallow, with more than 3,000 of its 5,000 acres less than 3 feet deep when the lake is at the spillway elevation. Lake levels tend to fluctuate between 938 and 942 in normal conditions however due to hydrologic alteration in the watershed, peak stages tend to consist of short-duration, flashy peaks followed by stabilization of pool elevation at the crest elevation of 937.6'. As evidenced by the 20-year period of record (Figure 2-6), the lake seldom drops below the spillway crest elevation of 937.6' for substantial periods of time. This regime is in stark contrast to natural riverine conditions which fluctuated with climate conditions and allowed for periodic drought and low water conditions in the lake prior to impoundment. Emergent aquatic plants require dewatered mud flat conditions to germinate from seed. Stable growing season water levels have prevented re-establishment of emergent aquatic plants in Marsh Lake.

Opportunity: Restore Marsh Lake Aquatic Ecosystem Processes and Connectivity

A key to restoring freshwater aquatic ecosystems is restoring a more natural hydrologic regime. On a river lake like Marsh Lake, a more natural hydrologic regime includes lower lake levels in some years to enable aquatic vegetation to re-establish. Growing season drawdowns to naturalize the hydrologic regime of shallow lakes and reservoirs have been conducted on Upper Mississippi River Pools 5, 8, 13, 24, 25, and 26, on Mud Lake at the Lake Traverse Flood Control Project on the Bois de Sioux River along the Minnesota-South Dakota border, at Swan Lake in south-central Minnesota, and on many other shallow lakes in the region. These drawdowns have resulted in increased extent, diversity, and abundance of aquatic vegetation, increased food for waterfowl, and improved water quality conditions, providing significant ecological benefits. Figure 3-1 illustrates the change in ecosystem state that a growing season drawdown, reduced wind-driven sediment resuspension, and reduced abundance of carp can produce.

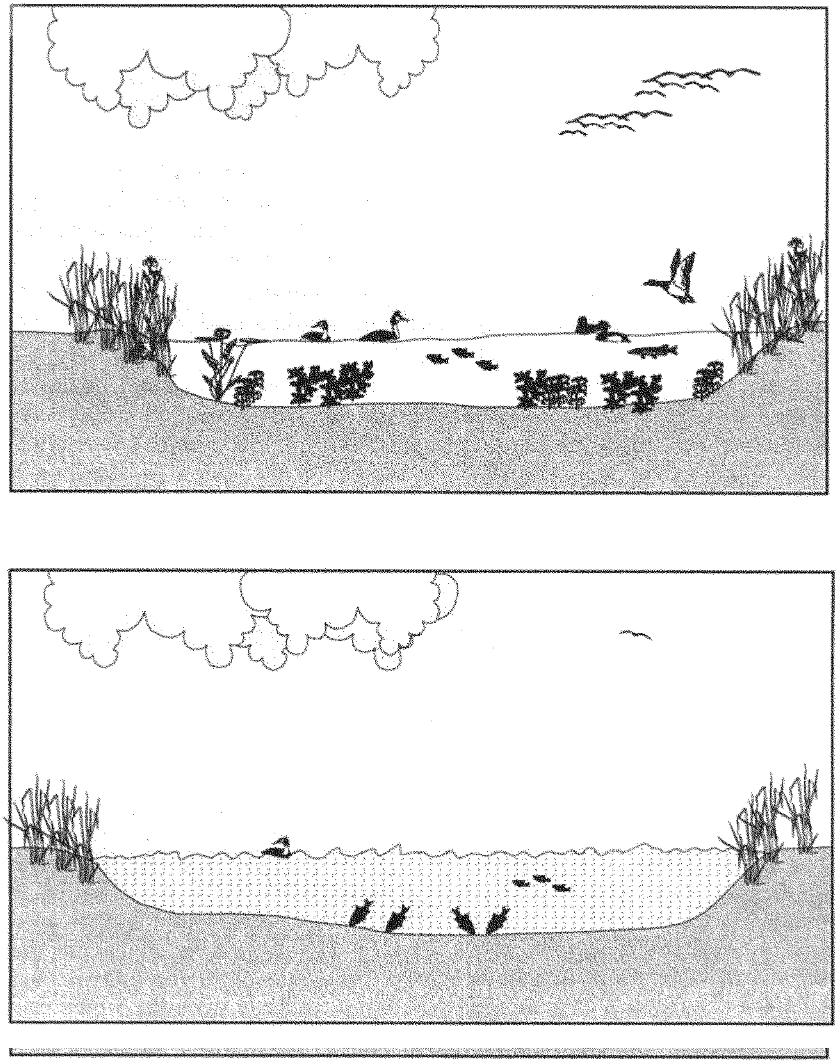


Figure 3-1. Schematic representation of a shallow lake in a vegetation-dominated clear state (upper panel) and in a turbid phytoplankton dominated state (lower panel) in which submersed aquatic plants are largely absent and where bottom-feeding fish and wind-driven waves resuspend the sediments. With permission from Martin Scheffer; (Scheffer 1998).

Low water levels during the growing season can contribute to a shift in ecosystem state of shallow lakes and reservoirs from turbid conditions with dense blue-green algal blooms dominated by plankton and detritus-feeding fish to clearer water condition with aquatic plants and game fish (Sheffer 1998, Strange 2007). Marsh Lake has exhibited such shifts in the past when in some years, lower water levels and ambient turbidity allowed aquatic plants to grow, dampening wave action and sediment resuspension. However, in most years, Marsh Lake has been in the turbid state without much aquatic vegetation (Figure 3-1 bottom panel), and a fish community dominated by common carp.

Opportunity exists to change the ecosystem state of Marsh Lake by naturalizing the water level regime, reducing wind fetch, reducing the abundance of common carp and by restoring aquatic vegetation. This can be done through modifying the dam to allow water level management, constructing islands to reduce wind fetch and by restoring the Pomme de Terre River to its former channel.

Opportunity exists for water level management that would simulate a more natural hydrologic regime through modification of the Marsh Lake Dam, the abandoned fish rearing pond area, and the Louisburg Grade Road culverts.

Marsh Lake has the potential to again be an important migration and feeding stop for many species of migratory waterfowl including ducks, geese, swans and shorebirds. With an increase in water clarity to levels experienced in 1991, Marsh Lake has the potential to grow significantly more sago pondweed tubers (Best and Boyd 2007) that are the preferred food for many waterfowl species during fall migration.

Opportunity: Enhance recreational opportunities in and around Marsh Lake
As noted in Section 2.9.9, Big Stone State Park, Lac qui Parle State Park and the Wildlife Management Area adjacent to Marsh Lake provide numerous opportunities for hunting, angling, active and passive recreation. The opportunity exists to enhance existing recreational opportunities with an ecosystem restoration project through three primary means:

1. Increase connectivity between recreational areas
2. Upgrade existing facilities and create new facilities where needed
3. Provide interpretation and education to visitors to the site

A detailed plan for improvement and enhancement of recreation facilities is included in Section 7.2 and has also been included in the overall cost estimates for the project.

Opportunity: Reduce public safety risks at Marsh Lake Dam

The Marsh Lake Dam has an ogee crest spillway with a strong hydraulic back-roller on the downstream end. Many people visit the Marsh Lake Dam and fish there. A drowning death occurred at the Marsh Lake Dam in July 1991. Alterations to the ogee crest spillway with measures to reduce the slope would eliminate the hydraulic roller and the public safety hazard in the immediate tailwater. The opportunity to address public safety risks is not in and of itself justification for the project, however, consideration towards addressing and minimizing the public safety risks is an opportunity presented if ecosystem restoration features are to be implemented at the site.

3.2 Problem: Low-Diversity Fish Community

The fish community in Marsh Lake is dominated by non-native common carp. Over two thirds of the biomass of fish in Marsh Lake is carp. Native game fishes like yellow perch, walleye, white bass, black crappies, and northern pike occur but in relatively low abundance.

Carp exacerbate the turbidity problem in Marsh Lake by bioturbation of sediment. Carp graze submersed aquatic plants, helping maintain an unvegetated and turbid ecosystem state in the lake.

Winter conditions in Marsh Lake favor carp. Water from the Pomme de Terre River maintains an oxygen refugia for carp during the winter. Northern pike are more tolerant of low dissolved oxygen than are carp. The fish community in the Pomme de Terre River is limited by access to suitable winter habitat in Lac qui Parle.

Diversion of the Pomme de Terre River has blocked fish migrations between Lac qui Parle and the Pomme de Terre River. Because Marsh Lake is shallow and has low winter dissolved oxygen conditions, fish in the Pomme de Terre River are denied access to suitable winter habitat.

Walleye and northern pike in Lac qui Parle do not have access to high quality spawning habitat because their historic migration pathways to Marsh Lake and the Pomme de Terre River have been blocked by the Marsh Lake Dam.

Opportunity: Restore the Native Fish Community

Opportunity exists to restore the native fish community by changing the ecosystem state of Marsh Lake toward a condition with clearer water and more aquatic plants. This would favor native fishes over the non-native common carp. Increased abundance of northern pike and walleyes in Marsh Lake would increase predation on common carp, contributing to improved water quality conditions.

Restoring the Pomme de Terre River to its former channel would provide walleyes and white suckers from Lac qui Parle access to rock and gravel spawning habitat in the Pomme de Terre River, eliminate the winter oxygen refugia for carp in Marsh Lake, reduce their abundance through winterkill, and would favor northern pike. Fish from the Pomme de Terre River would have access to suitable winter habitat in Lac qui Parle.

Restoring connectivity at the Marsh Lake Dam would enable fish from Lac qui Parle to migrate to high quality spawning areas (Figure 3-2). Northern pike would make use of the extensive marshes in upper Marsh Lake, and walleyes would migrate up the Pomme de Terre River to spawning areas with rock and gravel substrate. Restoring connectivity of habitats in river systems has been shown to be effective in increasing the abundance and spatial distribution of many species of native fishes (Hart et al. 2002).

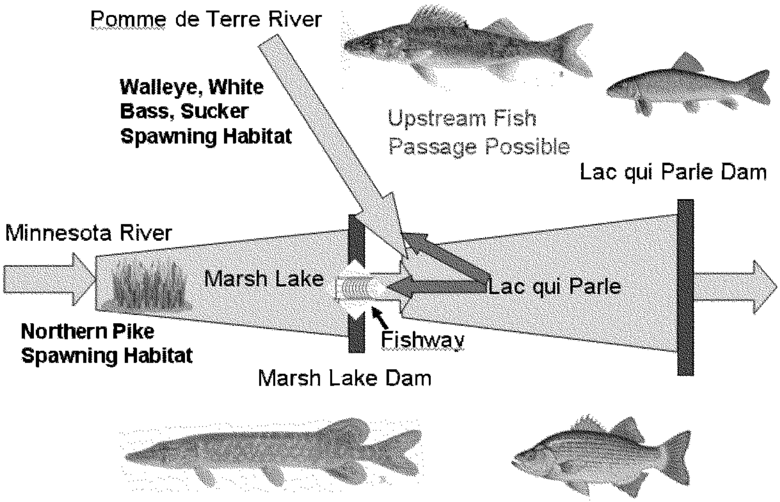


Figure 3-2. Conceptual model of fish migration routes restored from Lac qui Parle into the Pomme de Terre River and with a fishway at Marsh Lake Dam.

The U.S. Commission on Fish and Fisheries (1895) noted that a fishway was needed at the Appleton dam on the Pomme de Terre River. That dam failed and was replaced with a rock ramp fishway in 1996. Opportunity exists to restore fish migrations from Lac Qui Parle back into the Pomme de Terre River system, with 56 miles of river up to the dam at Marshall, Minnesota.

With improved fish passage, the native mussel community in Marsh Lake, Lac qui Parle and the Pomme de Terre River should receive benefits from the presence of their glochidial (larval stage) host fish species.

3.3 Problem: Degraded Pomme de Terre River Ecosystem State

The Pomme de Terre River was diverted into Marsh Lake when the dam was built in the 1930's. The river diversion was intended to conserve water in Marsh Lake. Water and suspended sediment from the Pomme de Terre River short circuits to the Marsh Lake Dam. Sediment from the Pomme de Terre has been depositing to form a delta in Marsh Lake rather than replenishing the floodplain at its confluence with the Minnesota River at the upper end of Lac qui Parle.

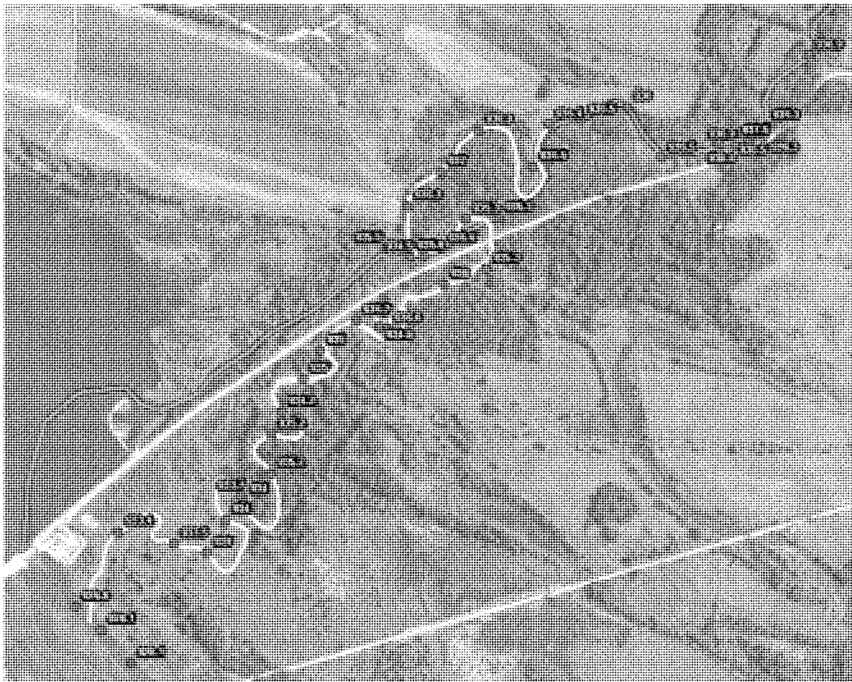


Figure 3-3. Former Pomme de Terre River channel (yellow). Re-routed Pomme de Terre River channel (blue).

Diversion of the Pomme de Terre River altered the floodplain and riparian habitat along the river. Sediment has accumulated in the former river channel. The channel and riparian area no longer receives flushing flows, new sediment deposition, and transport of organic material. The Pomme de Terre River provides carp in Marsh Lake a winter refugia with dissolved oxygen in some years. Diversion of the Pomme de Terre River eliminated 11,500 feet of river and its associated mussel community. It also resulted in a portage over the Marsh Lake Dam for canoeists to travel from the river into Lac qui Parle.

Opportunity: Restore Pomme de Terre River ecosystem processes and connectivity

Restoring river ecosystems by returning rivers to their former channels has proven to be ecologically effective worldwide. Opportunity exists to restore the Pomme de Terre River to its former channel and to restore its floodplain and riparian habitat in the upper end of Lac qui Parle. Restoring the Pomme de Terre River to its former channel would contribute to winter hypoxia in Marsh Lake, which would help reduce the abundance of carp, sediment resuspension and grazing on aquatic plants. Walleyes and white suckers from Lac qui Parle would have access to rock and gravel spawning habitat in the Pomme de Terre River. Fish in the Pomme de Terre River would have access to winter refugia in Lac qui Parle. A restored Pomme de Terre River would provide a canoe route linking the Pomme de Terre River with Lac qui Parle.

Opportunity: Enhance recreational opportunities on the Pomme de Terre River

Restoring the Pomme de Terre River to its former channel would enable canoeists and kayakers to follow the river to its confluence with the Minnesota River at the upper end of Lac qui Parle without having to portage over Marsh Lake Dam. Recreational use of the Pomme de Terre River within the project area is primarily by anglers and canoeists. A series of existing canoe launches and landings extends up the Pomme de Terre for open access and use. The opportunity exists to enhance the existing access to the river, particularly near the outlet with the Minnesota River, a primary takeout point for canoeists.

Table 3-1: Summary of Problems and Opportunities

Goal	Problem	Stressors	Opportunity
A return of the Marsh Lake area ecosystem to a less degraded, more natural and functional condition.	Degraded Marsh Lake Ecosystem State	Sediment Loading	1. Restore Marsh Lake ecosystem function, processes and connectivity 2. Enhance recreational opportunities in and around Marsh Lake 3. Reduce public safety risks at the Marsh Lake Dam
		Sediment Resuspension	
		Altered Hydrologic Regime	
		Ecosystem Connectivity	
	Low-Diversity Fish Community	Invasive Species	1. Restore native fish community 2. Enhance recreational fishing opportunities in and around Marsh Lake
		Ecosystem Connectivity	
	Degraded Pomme de Terre Ecosystem State	Sediment Deposition	1. Restore Pomme de Terre ecosystem function, processes and connectivity 2. Enhance recreational opportunities on the Pomme de Terre River
		Ecosystem Connectivity	

3.4 Project Goals and Objectives

The Marsh Lake Ecosystem Restoration Project study team considered the initial DNR goal and objectives and the team worked closely with the DNR to identify the following goal and objectives for the Marsh Lake Ecosystem Restoration Project:

Goal: A return of the Marsh Lake area ecosystem to a less degraded and more natural and functional condition.

Objectives:

1. Reduced sediment loading to Marsh Lake over the 50-year period of analysis
2. Restored natural fluctuations to the hydrologic regime of Marsh Lake over the 50-year period of analysis
3. Restored geomorphic and floodplain processes to the Pomme de Terre River over the 50-year period of analysis
4. Reduced sediment resuspension within Marsh Lake over the 50-year period of analysis

5. Increased extent, diversity and abundance of emergent and submersed aquatic plants within Marsh Lake over the 50-year period of analysis

6. Increased availability of waterfowl habitat within Marsh Lake over the 50-year period of analysis

7. Restored aquatic habitat connectivity between Marsh Lake, the Pomme de Terre River and Lac Qui Parle over the 50-year period of analysis

8. Reduced abundance of aquatic invasive fish species within Marsh Lake over the 50-year period of analysis

9. Increased diversity and abundance of native fish within Marsh Lake and the Pomme de Terre River over the 50-year period of analysis

Improving public safety, the recreation experience and public education at the Marsh Lake are not ecosystem restoration objectives and are therefore not included in the list above. They are, however, additional planning objectives to be considered in conjunction with the ecosystem restoration objectives.

3.5 Planning Constraints

Planning constraints are temporary or permanent limits imposed on the scope of the planning process and choice of solutions and include ecological, economic, engineering, legal, and administrative constraints. Some are states of nature; some are based on the design of built structures and other engineering considerations. Legislation and policy-making impose other constraints. The human-imposed constraints are possible to change. Following are the planning constraints identified in this study:

1. The planning process must be consistent with all applicable Federal laws, Executive Orders, Agency Regulations and other applicable policy.

2. The formulation of alternative measures should avoid, to the greatest extent possible, the reduction of the flood damage reduction benefits provided by the dams.

3. In its existing condition, Marsh Lake and the Pomme de Terre River provide functional habitat for a number of species. A universal constraint in the planning of ecosystem restoration projects is the maxim that the restoration activities should not

degrade, but rather seek to improve, the existing function of the ecosystem from its current state. Consideration of the potential adverse impacts to species within the project area therefore imposes constraints on the development of alternative measures. Specific biotic considerations include:

a. American Pelicans – a colony of nesting and breeding pelicans inhabits Marsh Lake during the summer months. Pelicans seek refuge on islands in the lake. Changes to water levels within the lake should minimize the impact on the isolation of these islands.
b. Mussels – A diverse mussel community exists within the lower reaches of the Pomme de Terre River. Consideration of project alternatives should minimize the impacts to this community and its future viability.
c. Fish Community – while the community is primarily dominated by common carp (an invasive species), Lac qui Parle and Marsh Lake also support communities of native fish. Changes to water levels resulting from alternative measures must minimize negative impacts on the native fish community, particularly valuable northern pike spawning habitat in the upper end of Marsh Lake.

3.6 Significance of Resources and Significance of Ecosystem Outputs

The criteria for determining the significance of resources are provided in the Federal Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (Water Resources Council 1983) and Corps planning guidance ER 1105-2-100. Protecting and restoring significant resources is in the national interest. The significance and the relative scarcity of the resources helps determine the Federal interest in the project.

Significant resources in the project area include natural and cultural resources that are recognized as significant by institutions and the public. For ecosystem restoration projects, the significance of resources is based on both monetary and non-monetary values. Monetary value is based on the contribution of the resources to the Nation's economy. Non-monetary value is based on technical, institutional or public recognition of the ecological, cultural, and aesthetic attributes of resources in the study area. The scientific community and natural resources management agencies recognize the technical significance of resources.

Through discussion with stakeholders and study participants, significant resources in the study area were identified.

Significant ecological and cultural resources in the project area include the following:

- Scenic beauty of the river
- Native American cultural resources in the floodplain
- Floodplain forest wetlands
- Emergent marsh wetlands
- Fish populations and a popular sport fishery supported by northern pike and walleyes
- Freshwater mussels in the Pomme de Terre River
- Migratory birds that use the Lac qui Parle Wildlife Management Area including ducks, Canada geese, swans, American pelicans, warblers, raptors, colonial-nesting pelicans, cormorants, herons and egrets
- Native prairie
- Bald eagles

Significance of ecosystem outputs are evaluated by institutional, technical and public criteria as provided in ER 1105-2-100 Appendix E-37. This guidance assists in addressing the challenge of dealing with non-monetized benefits associated with ecosystem restoration and provides context for the selection of the recommended plan.

Institutional Recognition Criteria: Constitutes significance of an environmental resource as acknowledged by laws, adopted plans and other policy statements of public agencies, tribes, or private groups. For the Marsh Lake Ecosystem Restoration Project, institutionally-recognized significant resources include the following:

A. Minnesota Department of Natural Resources (DNR): The State of Minnesota has made on-going investments in managing the Lac qui Parle State Park and the Lac qui Parle Wildlife Management Area. Marsh Lake is also one of the primary sites of the DNR Shallow Lakes long term evaluation and monitoring program. In addition, the DNR has also contributed to the development of several statewide conservation plans which address wildlife management broadly, but specifically focus on the loss of quantity and quality of shallow lakes for wildlife management. These include:

1. Minnesota Statewide Conservation and Preservation Plan
2. A Fifty-Year Vision – Minnesota Campaign for Conservation
3. Tomorrow's Habitat for the Wild and Rare
4. The Minnesota Department of Natural Resources Long-Range Duck Recovery Plan

The DNR serves as the non-Federal Sponsor for the study and its input as a team is provided with deference to the plans noted above. It is assumed that improvement to the ecosystem function of Marsh Lake will assist the DNR in meeting the goals of its multiple planning efforts.

B. The Minnesota State Historic Preservation Office (SHPO) considers the Marsh Lake Dam to be a significant resource eligible for listing on the National Register of Historic Places in connection with the Lac qui Parle Flood Control Project. The Dam typifies the type of design implemented under Works Progress Administration efforts. Coordination with SHPO is on-going throughout the Feasibility phase and overall project development.

C. The U.S. Fish and Wildlife Service (USFWS) recognizes the significance of the ecological resources in the project area, in particular migratory birds and their habitats. The project area is an important migration stop on a major flyway for waterfowl as well as part of a corridor for neotropical migrating songbirds. The study area is internationally significant as an important migratory bird resting and feeding area on the Mississippi flyway as recognized in the North American Waterfowl Management Plan by the Office of Migratory Bird Management. Many migratory species noted in Section 2.8.9 are also listed in the Office of Migratory Bird Management's official list. Coordination with USFWS is on-going throughout the Feasibility phase and overall project development.

D. The National Audubon Society recognizes the project area as part of a nationally significant Important Bird Area (IBA). IBA extends from Montevideo in Chippewa County along the Minnesota River northwest through Lac qui Parle Lake, Marsh Lake, Big Stone Lake, Lake Traverse, and Mud Lake. It extends to the east to include almost all of Big Stone County and the southwest portion of Traverse County. Included within this IBA are Lac qui Parle Wildlife Management Area, Chippewa Prairie Wildlife Management Area, Big Stone National Wildlife Refuge, Big Stone Lake State Park, Lac qui Parle State Park, and Bonanza Prairie State Natural Area. The habitat in the Minnesota River IBA is a diverse mixture of lakes, prairie potholes, prairie grasslands, river bottom lakes, riparian woodlands, cattail marshes, rocky pastures and cropland. This IBA includes large waterbird nesting areas and some of the highest quality tallgrass prairie in the Midwest. This has resulted in a rich diversity of species including some of Minnesota's largest concentrations of Canada Geese and other waterfowl, the world's largest American American pelican breeding colony, and other waterbirds, shorebirds and grassland songbirds. Ecosystem outputs associated with restoration efforts within the project area will presumably enhance the values noted by the IBA through increased habitat suitability.

E. The Nature Conservancy has also provided technical and institutional recognition of the Minnesota River, including the Marsh Lake project area, as a conservation priority area (The Nature Conservancy 2003). While recognizing the highly altered ecosystems in the Minnesota River Basin, The Nature Conservancy notes that there are still areas of high biological diversity and habitat quality, largely confined to the main-stem floodplain and lower portions of tributaries. These areas harbor a large variety of remnant terrestrial and semi-aquatic communities, including prairies, upland and lowland hardwood forests, marshes, fens, seepage wetlands and other unique natural features. Ecosystem outputs associated with restoration efforts will complement the recognition of the conservation priority area by improving the quality of resources and habitat suitability.

F. Ducks Unlimited Inc. (DU) works to restore habitat conditions for waterfowl in Minnesota through its Living Lakes Initiative (LLI). The LLI recognizes the project area as a critical migratory stop-over for waterfowl and has utilized public and private funds to help restore 110-acres of wetland around Marsh Lake itself. DU has contributed feedback on the Feasibility Report through the Minnesota DNR and is supportive of ecosystem restoration of Marsh Lake.

In addition to institutional recognition, the public recognizes the significance of certain environmental resources. Public recognition of the significance of a resource may involve membership in a conservation organization, financial contributions to resource-related efforts, providing volunteer labor, and correspondence regarding the importance of the resource. As noted above, several non-profit organizations have indicated interest in improving the ecosystem quality and function of the Marsh Lake and Lac qui Parle (Audubon, The Nature Conservancy, DU). Several citizens groups have also formed around improving conditions on the Minnesota River as well as within the project area including:

A. Clean Up the River Environment (CURE)
B. Friends of the Minnesota Valley
C. Coalition for a Clean Minnesota River
D. Minnesota River Board; consisting of delegates from each of the Counties within the Minnesota River Basin

Coordination with the general public and non-profit groups active within the project study area will occur during public review of the Feasibility Report.

In addition to institutional and public recognition of significant resources, technical recognition means that a resource qualifies as significant based on its merits, which are based on scientific knowledge or judgment of critical resource characteristics. Some technical reasons that resources in the study area are considered significant include:

A. Status and Trends – 90% of Minnesota prairie wetlands have been lost due to hydrologic alteration of the landscape, primarily for agricultural use. Those wetlands that remain are often larger basins that were more difficult to drain. Given the reduced storage capacity within watersheds, the remaining wetlands in the project area are under increasing stress from runoff carrying sediments, nutrients and other contaminants which impact overall water quality and ecosystem health.

B. Connectivity – Marsh Lake and Lac qui Parle are artificially constructed impoundments on the main stem of the Minnesota River. Given their direct hydrologic connection to upstream and downstream river reaches as well as tributaries such as the Pomme de Terre, the project area serves a critical connective function for aquatic fauna such as fish and amphibians, particularly for reproduction and forage. As noted in previous sections of the report, the project study area is a critical stopover for both ducks and geese. Peak numbers of 150,000 Canada geese and 20,000 mallards have been recorded within the Wildlife Management Area which in part is managed as a Migratory Feeding and Resting Area (DNR). Ecosystem restoration features are targeted at improving connectivity and function of the system for aquatic species and birds.

C. Limiting Habitat – There are relatively few remaining wetland and shallow lake habitat areas in western Minnesota. Marsh Lake and Lac qui Parle provide habitat for an active breeding colony of white pelicans, one of only two in the entire state. White pelicans, in addition to 30 other identified species within the study area, are listed as a species of special concern by the Minnesota Department of Natural Resources.

D. Biodiversity – Even with the presence of invasive species such as common carp, the project area supports a rich and diverse abundance of wildlife, detailed in Section 2.8.8. A number of the stated project objectives relate to increasing the diversity and impact of invasive species through the implementation of identified measures. Invasive species have thrived in the project study area primarily due to the human-induced conditions. Restoration of the natural form and function of the ecosystem will tend to favor habitat conditions and production of native species and natural biodiversity.

4. Alternative Measures

Alternative measures are management actions that singly or in combination may contribute to attaining the project objectives. Each project objective has a set of potential management actions (Table 4-1). Most of the potential alternative measures listed in Table 4-1 were considered in the 2000 – 2002 DNR Marsh Lake planning process. Some management actions would contribute to attaining more than one objective.

Table 4-1. Alternative measures that could contribute to attaining project objectives.

Goal	Problem	Sub-Category	Objective	Output	Alternatives
A return of the Marsh Lake ecosystem to a less degraded, more natural and functional condition	Marsh Lake Ecosystem State	Sediment Loading	Reduced sediment loading to Marsh Lake over the 50-year period of analysis	1. Reduced turbidity 2. Increased aquatic plan growth 3. Increased availability of forage for waterfowl	• Watershed BMPs • Wetland restorations in watershed • Stream bank stabilization in watershed • Reroute lower Pomme de Terre River to its former channel
		Sediment Resuspension	1. Reduced sediment loading to Marsh Lake over the 50-year period of analysis 2. Increased extent, diversity and abundance of emergent and submersed aquatic plants within Marsh Lake over the 50-year period of analysis 3. Reduced sediment resuspension within Marsh Lake over the 50-year period of analysis 4. Increased availability of waterfowl habitat within Marsh Lake over the 50-year period of analysis	1. Reduced turbidity 2. Increased aquatic plan growth 3. Increased availability of forage for waterfowl	• Growing season drawdowns to restore emergent aquatic plants • Construct islands to reduce wind fetch • Construct exclosures to prevent grazing and plant submersed aquatic vegetation
		Lake Level Variability	1. Restored natural fluctuations to the hydrologic regime of Marsh Lake over the 50-year period of analysis 2. Increased extent, diversity and abundance of emergent and submersed aquatic plants within Marsh Lake over the 50-year period of analysis	1. Increase light attenuation 2. Increase frequency of consolidation of bottom sediments 3. Increase frequency of germination of aquatic plant seedbed 4. Increased aquatic plant abundance and diversity 5. Increased availability of forage for waterfowl	• Modify Marsh Lake Dam to attain target water levels • Growing season drawdowns to restore emergent aquatic plants • Winter drawdowns to reduce carp abundance • Install gated culverts in the Louisburg Grade Road to manage water levels in upper Marsh Lake • Install gated culverts in abandoned fish pond to manage water levels • Breach dike in abandoned fish pond • Breach or remove the Marsh Lake Dam
		Ecosystem Connectivity	Restored aquatic habitat connectivity between Marsh Lake, the Pomme de Terre River and Lac Qui Parle over the 50-year period of analysis	1. Increase the frequency of immigration of native fish between Lac qui Parle and Marsh Lake 2. Increase quality of habitat for piscivores	• Construct a fishway in the Marsh Lake Dam • Restore the lower Pomme de Terre River to its former channel • Breach dike in abandoned fish pond • Breach or remove the Marsh Lake Dam
	Low-Diversity Fish Community	Invasive Species	1. Reduced abundance of aquatic invasive fish species within Marsh Lake over the 50-year period of analysis 2. Increased diversity and abundance of native fish within Marsh Lake and the Pomme de Terre River over the 50-year period of analysis	1. Increase availability of spawning habitat for northern pike 2. Increase availability of spawning habitat for walleye 3. Reduce abundance of invasive fish species	• Construct a fishway in the Marsh Lake Dam • Restore the lower Pomme de Terre River to its former channel • Winter drawdowns to reduce carp abundance
		Ecosystem Connectivity	Restored aquatic habitat connectivity between Marsh Lake, the Pomme de Terre River and Lac Qui Parle over the 50-year period of analysis		
	Degraded Pomme de Terre Ecosystem State	Sediment Deposition	Reduced sediment loading to Marsh Lake over the 50-year period of analysis	1. Reduced turbidity 2. Increased aquatic plan growth 3. Increased availability of forage for waterfowl	• Watershed BMPs • Wetland restorations in watershed • Stream bank stabilization in watershed • Reroute lower Pomme de Terre River to its former channel
		Ecosystem Connectivity	1. Increase the diversity and abundance of native fish in the Pomme de Terre River 2. Restored geomorphic and floodplain processes to the Pomme de Terre River over the 50-year period of analysis 3. Restored aquatic habitat connectivity between Marsh Lake, the Pomme de Terre River and Lac Qui Parle over the 50-year period of analysis	1. Increase the frequency of immigration of native fish between Lac qui Parle and Marsh Lake 2. Increase availability of spawning habitat for walleye	• Reroute lower Pomme de Terre River to its former channel

4.1 Description of Alternative Ecosystem Restoration Measures

4.1.1 Watershed Best Management Practices (BMPs)

A variety of watershed BMPs can be implemented to reduce sediment and nutrient loading to Marsh Lake and Lac qui Parle. These include nutrient management on farms, installation of grassed waterways and buffer strips along streams, conservation tillage, and conversion of row crop land to perennial cover. Watershed BMPs are implemented by landowners with cost share assistance from state and USDA soil and water conservation programs.

4.1.2 Wetland Restorations in Watershed

Restoration of wetlands that have been drained for agriculture can be very effective at restoring the hydrologic regime, reducing loading of sediment and nutrients, and providing habitat for wildlife. Restorations of drained wetlands are implemented by landowners with cost share assistance from the U.S. Fish and Wildlife Service and from state and USDA soil and water conservation programs.

4.1.3 Stream Bank Stabilization in Watershed

Agricultural drainage and ditching has altered the stream drainage network in the Upper Minnesota River watershed and tilling perennial grasslands has led to destabilization of stream channels. Measures to restore the hydrologic regime and to stabilize stream channels can reduce loading of sediment and nutrients to Marsh Lake and Lac Qui Parle. Restorations of stream channels are implemented by landowners with cost share assistance from state and USDA programs.

4.1.4 Restore the Lower Pomme de Terre River to its Former Channel

Currently, the channelized lower Pomme de Terre River flows into Marsh Lake and short circuits to the overflow spillway at Marsh Lake Dam. The bed sediment has been depositing a delta in Marsh Lake, and the suspended sediment flows toward the Marsh Lake Dam and on into Lac qui Parle. Rerouting the lower Pomme de Terre River to its former channel and floodplain at the confluence with the Minnesota River downstream of Marsh Lake Dam (Figure 4-1) would restore natural floodplain processes. Sediment from the Pomme de Terre River would be deposited overbank in the floodplain during higher discharge events. The sediment in the former river channel is currently about 0.5 feet of silt over the former sand/gravel substrate. This fine material would be scoured out in the first year following restoring flow to the former channel therefore no excavation will be required to reestablish the historic channel.

The Pomme de Terre River would be re-routed into its former channel in a meander loop upstream of Marsh Lake Dam and into the longer former channel downstream of the Marsh Lake Dam by constructing three earthen cut-off dikes (Figure 4-1). The total length of river channel that would be restored would be 11,500 feet. With an average 80-ft wide channel, approximately 21 acres of river channel would be restored. This would restore floodplain processes to the Pomme de Terre River delta downstream of the Marsh Lake Dam, a 293-acre area.

The upstream cut-off dike would be armored with rock on the upstream side to withstand river currents. The top of the upstream cut-off dike would be about one foot higher than the surrounding floodplain, allowing it to be overtopped during floods. The top of the downstream cut-off dike and the west cut-off dike would be at the same elevation as the Marsh Lake Dam embankment, at 950 ft. The west cut-off dike would involve raising a township road, also to 950 ft. The downstream and west cut-off dikes would effectively become part of the Marsh Lake Dam embankment. A total of 39,800 cubic yards of earth fill would be used to construct the cut-off dikes.

Clay material to construct the cut-off dikes would be borrowed from the field northwest of the downstream cut-off dike within the Lac Qui Parle Wildlife Management Area. The borrow area would be approximately 5.7 acres, excavated to a depth of 4 feet. Lake bed material excavated from the approach to the drawdown structure in Marsh Lake Dam would be used to partially fill and top dress the borrow area. The borrow area would be planted to native grasses following construction.

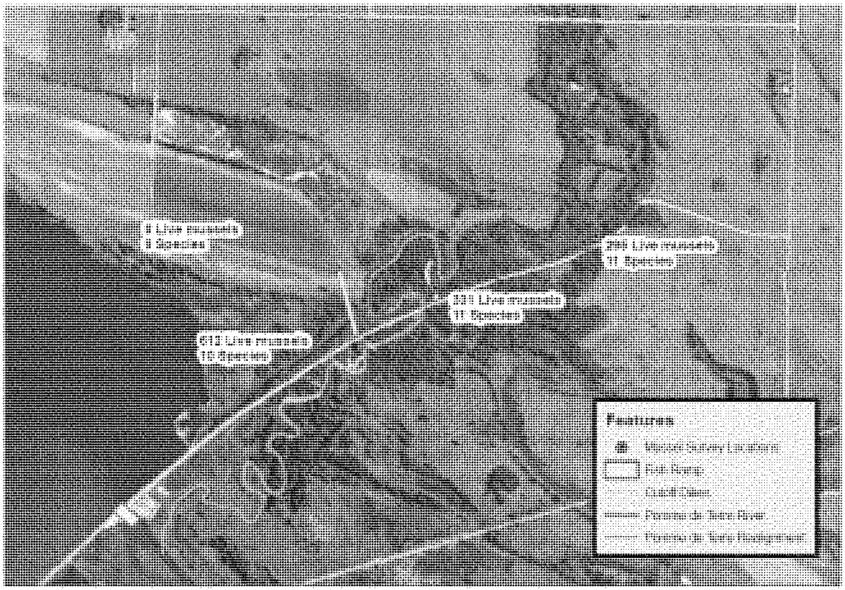


Figure 4-1. Pomme de Terre River existing channel (purple), realignment into former channel (blue), earthen cut-off dikes (green), 2007 mussel sampling locations (red).

The lower Pomme de Terre River supports an abundant and diverse mussel community with two state-listed species (See Section 2.8.7 above). Mussels in the lower reach of the channelized Pomme de Terre River below the lower cut-off dike would no longer be in a flowing river and would probably die. Mussels in the locations of the cut-off dikes would be buried.

Based on discussions with the DNR, this alternative measure would include a survey of the existing mussel community in the lower Pomme de Terre River and monitoring the recolonization of the restored river channel as part of the Marsh Lake project. There is not a Federal interest in a large-scale mussel relocation effort for a native mussel community containing no Federally-listed endangered or threatened species.

If the DNR chooses to do so, the DNR may harvest mussels from the impact area in the lower Pomme de Terre River and temporarily relocate the mussels to selected areas in the Pomme de Terre River upstream. PIT (passive integrated transponder) tags could be attached to relocated mussels and then used to find them later. Following a year or two of flow through the restored channel to allow the fine-grained sediment to be scoured down to the underlying sand-gravel substrate, the mussels in the temporary relocation sites could be removed and stocked into the restored river channel above and downstream of the Marsh Lake Dam. Parts of the restored channel would not receive relocated mussels and would serve as a control to enable monitoring of mussel recruitment and recolonization. A reference reach of the Pomme de Terre River upstream of the impact area was surveyed for mussels in 2010 (Appendix Q).

Survey of the Existing Lower Pomme de Terre River and Mussel Community

A systematic survey of the impact area of the lower Pomme de Terre River was done in 2010 by collecting 0.25 m^2 randomly located quadrat samples (Appendix Q). Additional sites not sampled in the 2007 survey were sampled by qualitative timed searches to better assess the species richness of the mussel community. From these data a population estimate, population demographics and community composition descriptors were generated and will be used as perspective when characterizing the recruitment of mussels into the restored channel over time. A map of the river showing the density of mussels, number of mussels <3 years old, and number of species found at each collection site was generated (Appendix Q).

A cursory survey of several sites within the old channel consisting of wading and snorkeling where needed will be done to support or refute the assumption that there are no live mussels currently in the former Pomme de Terre River channel to be restored. The former Pomme de Terre River channel to be restored has had six or more inches of silt deposited there since the river was diverted when the Marsh Lake Dam was built. Mussels are unlikely to occur there now. Following three years of flow through the restored areas above and below the Marsh Lake Dam, biologists will survey the restored river channel using qualitative timed searches at a minimum of 5 sites to assist in finding all species present and systematic quantitative sampling similar to that used within the impact area. At least 100 0.25 m^2 quadrat samples will be collected as described above to allow for a population estimate of mussels that may have been recruited since restoration of flows. Mussels collected during this sampling will be identified to species, measured (TL) and growth arrest lines counted. Qualitative information on the substrate types represented at each sample will be estimated and recorded as a percent among 7 substrate categories:

Woody debris, Organic Detritus, Silt, Sand, Gravel, Cobble, or Boulder. A map of the river showing the density of mussels, number of mussels <3years old, and number of species found at each collection site will be generated.

Consideration (assessment of the existing and monitoring to assess reestablishment in restored channel) of the existing mussels, their habitat, and the ecosystem services they provide is an important part of this project to the DNR. Approaches to accomplish that, to the best of existing knowledge, are currently being worked on are partially listed above. These may include: organism identification, enumeration, and valuation using American Fisheries Society (AFS) replacement numbers; habitat mapping and valuation, and ecosystem service identification and valuation. The DNR's involvement in accomplishing this aspect of the project can be assumed. A more complete experimental design will be developed in the detailed design phase of the project.

Estimated cost for the lower Pomme de Terre pre-project survey and three years of post-project monitoring was provided by the Minnesota DNR (Table 4-2). The estimated total cost of $128,000 includes data analysis and reporting.

Table 4-2. Estimated cost of Pomme de Terre River survey and monitoring mussel recolonization in the restored Pomme de Terre River channel.

Tasks	Days	# Crews	Per Day/one crew	Report	Total
Est. Current Channel Pop & Reference site	6	2	$ 2,000.00	$ 2,000.00	$ 26,000.00
Evaluate New Channel	1	2	$ 2,000.00	$ 2,000.00	$ 6,000.00
Cutoff Channel Mussel Salvage	2	2	$ 2,000.00	$ 1,000.00	$ 9,000.00
Yr3 Monit; New Channel/Reference site	6	2	$ 2,000.00	$ 5,000.00	$ 29,000.00
Yr6 Monit; New Channel/Reference site	6	2	$ 2,000.00	$ 5,000.00	$ 29,000.00
Yr10 Monit; New Channel/Reference site	6	2	$ 2,000.00	$ 5,000.00	$ 29,000.00
				Total	$ 128,000.00

Bridge Over the Pomme de Terre River

A bridge over the re-routed Pomme de Terre River channel would be constructed to maintain access to Marsh Lake Dam (Figure 4-2). The bridge would be 450 feet long with 5 spans and be constructed of 46" deep concrete I-girders. The bridge would be designed to carry cars, trucks, materials and equipment needed to provide continued public access and to maintain the Marsh Lake Dam. The deck of the bridge would be 40 feet wide to carry two lanes of traffic.

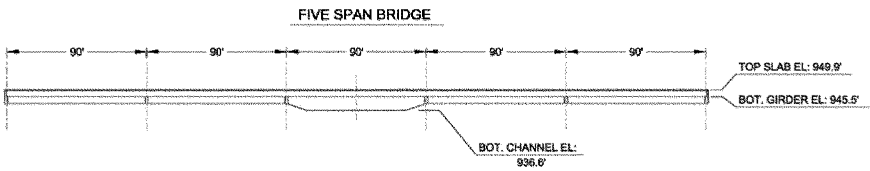


Figure 4-2. Conceptual design of a bridge over the re-routed Pomme de Terre River.

4.1.5 Modify Marsh Lake Dam to Attain Target Water Levels and Construct a Fishway (Passive water level management)

Marsh Lake Dam could be modified with a fishway structure to provide a passive weir that would increase water level variability on Marsh Lake, attain the target water level regime and to allow year-round fish passage (Figure 4-4). The fishway would be constructed in the existing fixed crest spillway in Marsh Lake Dam. The fishway was designed by comparing a number of alternatives to optimize the time that the lake is in the target range of water levels (Objective 2) and to have suitable velocities within the fishway to allow upstream fish passage to provide habitat connectivity for fish through the Marsh Lake Dam (Objective 7). In order to maintain desired pool elevations for protection of nesting waterfowl, through discussions with the DNR, the average September Marsh Lake water level of 937.7 ft was selected as the target water level elevation (Figure 4-5).

Nature-like fishways are effective in re-establishing fish migration routes past dams and other hydraulic obstacles. Nature-like fishways simulate natural river channels and the hydraulic conditions that fish have evolved to swim through. Nature-like fishways can be simple rock ramps that look like natural rapids or bypass channels with riffles and pools. Many nature-like fishways have been constructed in Minnesota and have been very effective in restoring migratory fishes to stream networks (Figure 4-3) (L. Aadland, Minnesota DNR, personal communication).

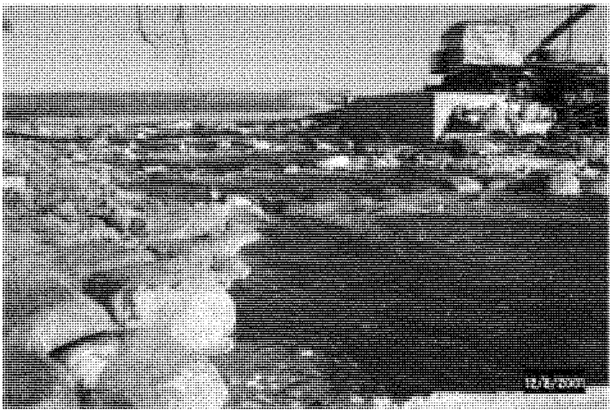


Figure 4-3. Rock ramp fishway at a lake outlet. Minnesota DNR photo.

The fishway would be constructed in the location of the existing fixed ogee crest spillway in the Marsh Lake Dam. The fishway would have a series of arched rock riffles (Figure 4-4). This would concentrate flow toward the middle of the fishway. Shallow areas on the sides would have slower current velocities and would allow upstream passage by smaller and weaker-swimming fish. The riffles would be made of boulders imbedded into smaller rock, with pools of deeper water between the riffles. Water would flow between the boulders in the riffles at velocities that fish could still swim through. Each riffle would produce a head loss of approximately 0.8 ft.

The fishway would be constructed with a rock fill base at a 4% slope, nine boulder weir "steps" of 0.8-ft head each, 20-ft spacing between the boulder weirs, a 30-ft wide notch in the existing spillway from 937.6 ft down to 935.5 ft, a 30-ft wide V-notch in base rock, with invert of 936.0 ft.

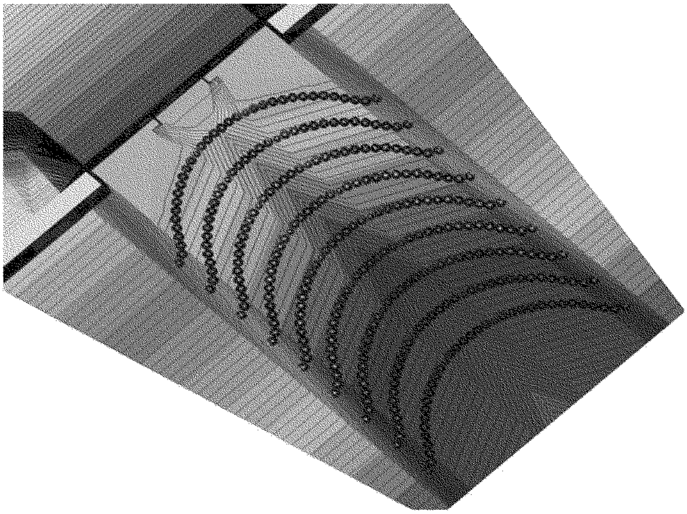


Figure 4-4. Conceptual design of a Marsh Lake fishway. Flow from upper left to lower right.

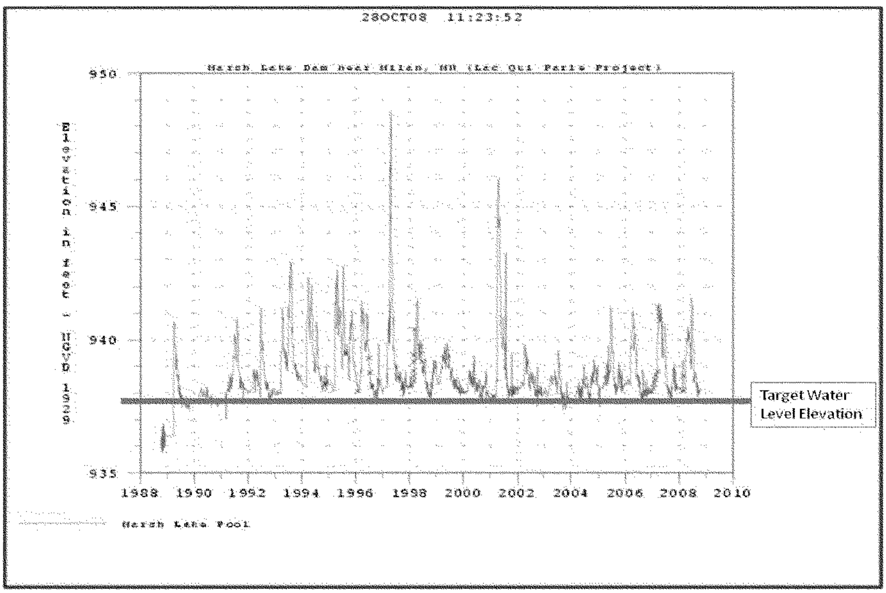


Figure 4-5. Historic Marsh Lake water levels and the 437.7 ft September target water level elevation.

4.1.6 Construct Water Level Control Structure to Allow Drawdowns to Restore Emergent Aquatic Plants and Reduce Carp Abundance (Active Water Level Management)

Growing season drawdowns are effective in providing dewatered mud flat conditions that emergent aquatic plants need to germinate from seed (Figure 4-6).

Figure 4-6. Seedling arrowhead and other emergent aquatic plants on exposed mud flats in Pool 8, Mississippi River, during a 2005 growing season drawdown.

Growing season drawdowns are typically conducted following spring high water into September when plants go senescent. Growing season drawdowns can be done in two consecutive growing seasons to allow plants germinated in the first year to grow to full size before flooding to normal water levels. Once established, perennial aquatic plants can persist for years, providing valuable food and habitat for fish and wildlife.

Drawdowns on Marsh Lake would require modifications to the Marsh Lake Dam to allow active water level management. A water control structure would be built in the existing overflow spillway area to provide controlled discharge capacity to enable a drawdown. The ability to maintain the pool in a drawdown condition with less than one week of high water following a runoff event is needed to prevent "drowning" of newly germinated emergent aquatic plants. This was used as design criteria for the water control structure (Figure 4-7).

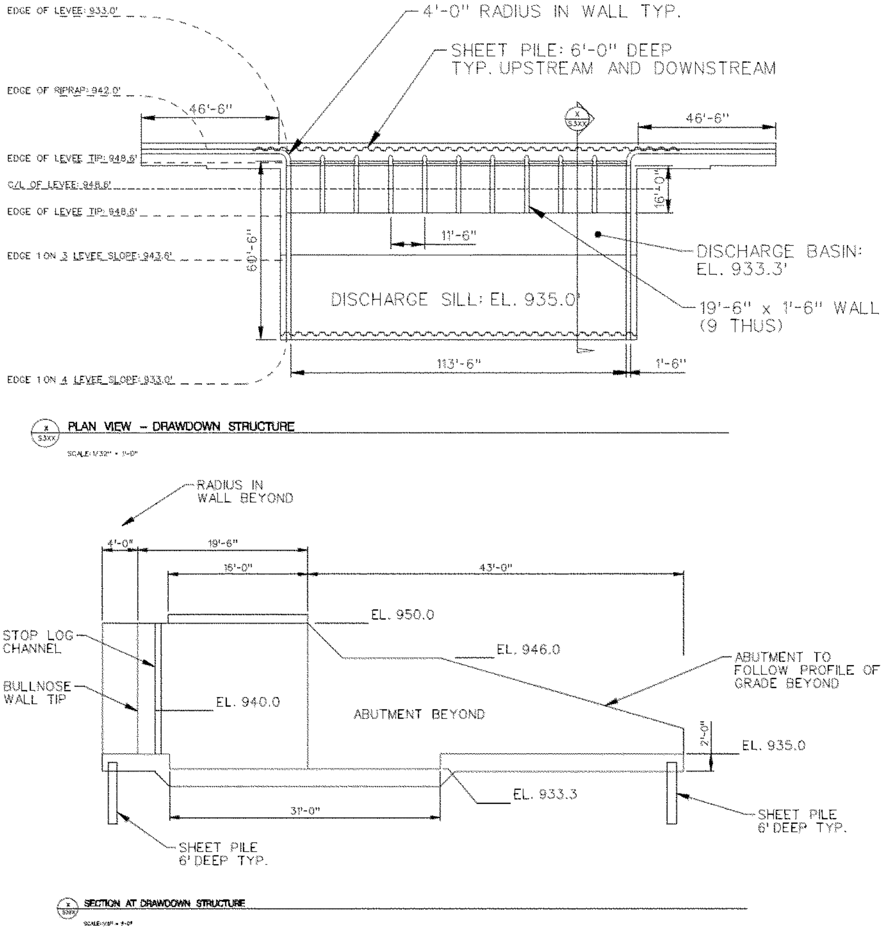


Figure 4-7. Conceptual design of a drawdown water control structure for the Marsh Lake Dam.

The drawdown structure would be 113.5-feet wide with 10 bays. The water control structure would have a 16-ft wide walkway across the top that could serve a secondary purpose as part of a trail across the dam in the future.

The structure would enable drawdown of approximately 90 percent of the lake to elevation 935 ft for winter drawdowns, dewatering approximately 3,569 acres of lake bed (Figure 4-8).

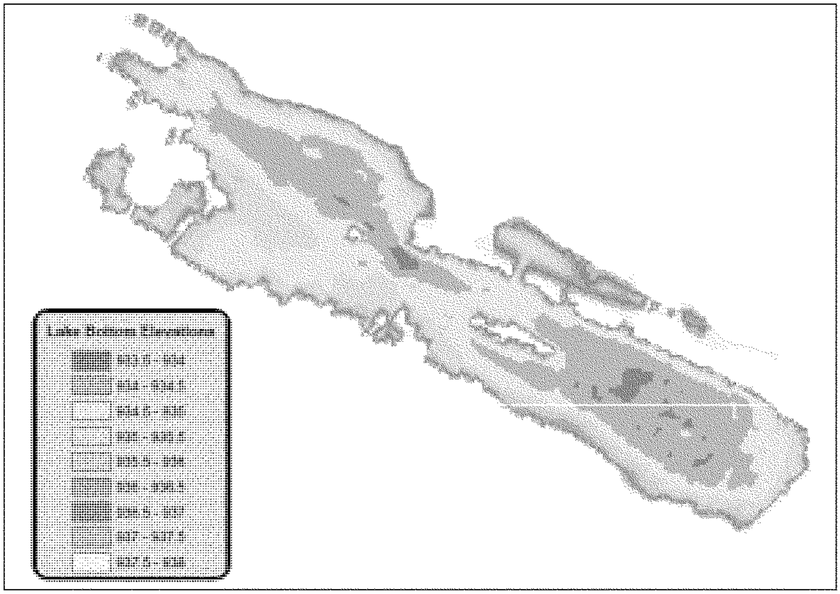


Figure 4-8. Marsh Lake flooded area outline at different water surface elevations.

Growing season drawdowns of the Marsh Lake pool should maintain a minimum elevation of 936.0 ft to prevent mainland predators from accessing the colonial bird nesting islands. Growing season drawdowns would expose 2625 acres of lake bed, allowing germination of emergent aquatic plants.

The frequency of drawdowns would be based on the extent of emergent aquatic vegetation. When the area of emergent aquatic vegetation in Marsh Lake falls below 1500 acres (see Objective 5 above), a growing season drawdown would be conducted the next year if river discharge allows.

Winter Drawdowns to Reduce Carp Abundance

Winter drawdowns would reduce the volume of water in Marsh Lake and the amount of available dissolved oxygen, imposing hypoxia stress and winterkill on carp. Winter drawdowns would stress other fish species and would kill most submersed aquatic plants except sago pondweed, which is the most common submersed aquatic plant in Marsh Lake and the target species for structural enhancement to the ecosystem. Sago pondweed is resistant to freezing if snow covers the dewatered sediment. Winter drawdowns on Marsh Lake would also require a water control structure in the Marsh Lake Dam to allow active water level management as described above. Winter drawdowns would be implemented following growing season drawdowns or separately as needed to limit carp abundance in Marsh Lake and meet project Objective 8. As noted above, winter drawdowns will stress the existing fish community, primarily dominated by invasive carp, but will allow native fish to reestablish within the lake in the following spring, ultimately shifting the dominance from invasive species to the native community. Winter drawdowns would be to the sill elevation of the stoplog control structure, 935.0 ft, leaving 2425 acres of water in Marsh Lake, most of which would freeze to the bottom.

4.1.7 Install Gated Culverts on Louisburg Grade Road

The existing culverts under the Louisburg Grade Road (Figures 4-9, 4-10) drain water from the upper end of Marsh Lake. The Louisburg Grade Road is owned and maintained by Akron Township of Big Stone County. The culverts are deteriorating and should be replaced. A natural river levee of higher ground exists along the Minnesota River upstream of the Louisburg Grade Road. New culverts with stoplogs would allow active management of water levels in the upper end of Marsh Lake.

Water levels in the upper part of Marsh Lake could be managed separately from the main body of the lake. For example, high water levels could be maintained for a time in early spring to provide flooded marsh habitat upstream of the Louisburg Grade Road for spawning northern pike and to improve survival of young-of-year fish. The stop logs could then be removed to allow the fish to return to Marsh Lake.

Figure 4-9. Culverts under the Louisburg Grade Road at the upper end of Marsh Lake.

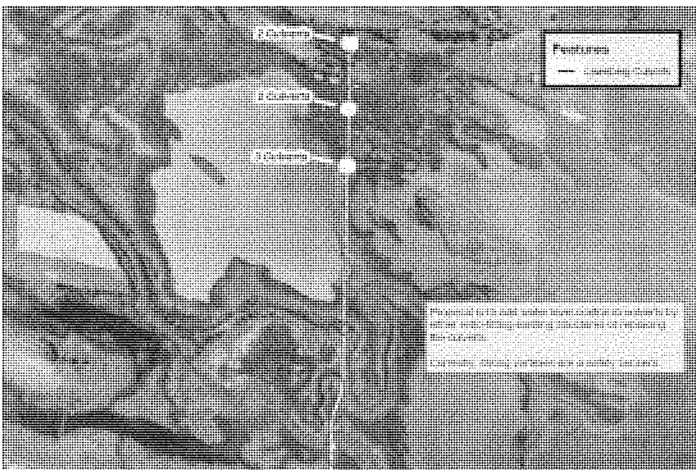


Figure 4-10. Location of culverts under the Louisburg Grade Road at the upper end of Marsh Lake.

Water levels in the upper part of Marsh Lake could also be managed separately from the main body of the lake to provide deeper marsh habitat during years when growing season drawdowns are implemented on Marsh Lake. This would provide habitat for nesting waterfowl and furbearers when much of the rest of Marsh Lake is dewatered.

4.1.8 Install Gated Culverts and Pump System on Abandoned Fish Pond

The abandoned fish pond on the downstream side of the Marsh Lake Dam (Figure 4-11) currently is shallow un-vegetated aquatic habitat without connection to Lac qui Parle. If the existing inlet and outlet structures were rehabilitated or new ones installed, the abandoned fish pond could be operated as a moist soil management area to produce food for shorebirds and waterfowl, and/or to provide spawning habitat for northern pike. If it were to be operated as a moist soil management unit, a pump would be needed to maintain low water levels for emergent plant germination.

4.1.9 Breach Dike on Abandoned Fish Pond

Breaching the dike in one or more places on the abandoned fish pond would allow water levels within it to be the same as in the upper end of Lac qui Parle, and would allow fish access to the area. The shallow abandoned fish pond area would also provide shorebird habitat during times when Lac qui Parle water level is low.

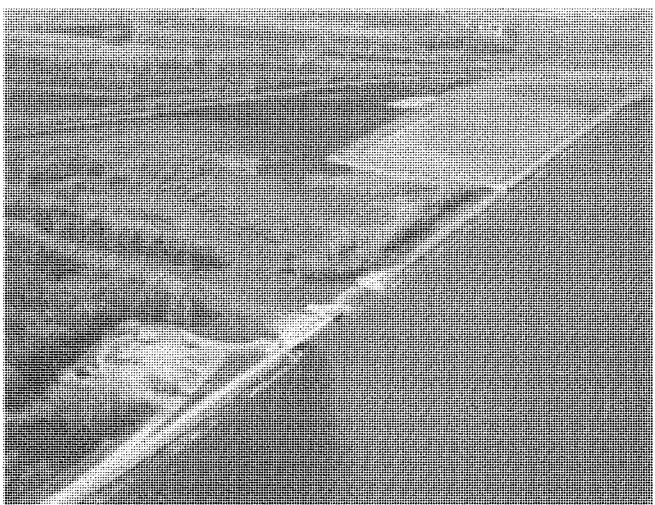


Figure 4-11. Marsh Lake Dam with abandoned fish rearing pond at upper right.

4.1.10 Breach or Remove Marsh Lake Dam

The Marsh Lake dam would be removed or breached in several locations, allowing free flow of the Minnesota River into Lac Qui Parle.

4.1.11 Construct Islands in Marsh Lake

Islands can be constructed to break up wind fetch, reduce sediment resuspension, encourage the growth of submersed aquatic vegetation, provide protected areas for fish and waterfowl, and to provide loafing habitat for colonial waterbirds (Figures 4-12 and 4-13). The size, layout and number of islands that would most effectively reduce wind fetch and wave action on Marsh Lake was designed using a wind fetch model (Rohweder et al. 2008) (See Section 2.4).

Additional considerations were applied to the island design by the DNR to avoid public use, and navigation problems. A variety of island designs were considered, ranging from simple rock breakwaters to islands that incorporate mud flats and ponds within them. Given the adequate number of existing islands for nesting colonial waterbirds on Marsh Lake, no additional islands are needed for bird nesting.

This alternative measure consists of simple rock islands that break wave action. Islands of this type also shelter areas allowing submersed aquatic plants to grow and they also provide sheltered feeding and resting areas for birds.

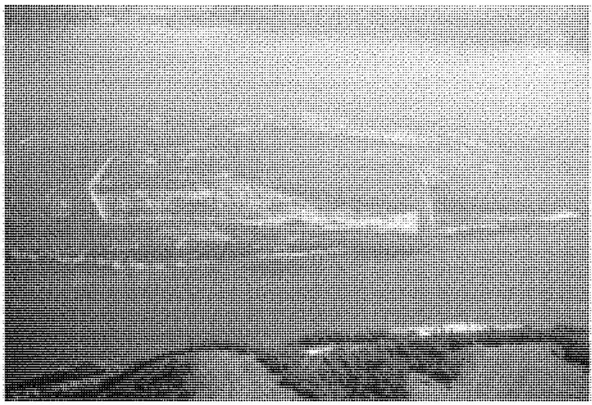


Figure 4-12. Constructed rock island sheltering aquatic vegetation. Pool 9, Mississippi River.

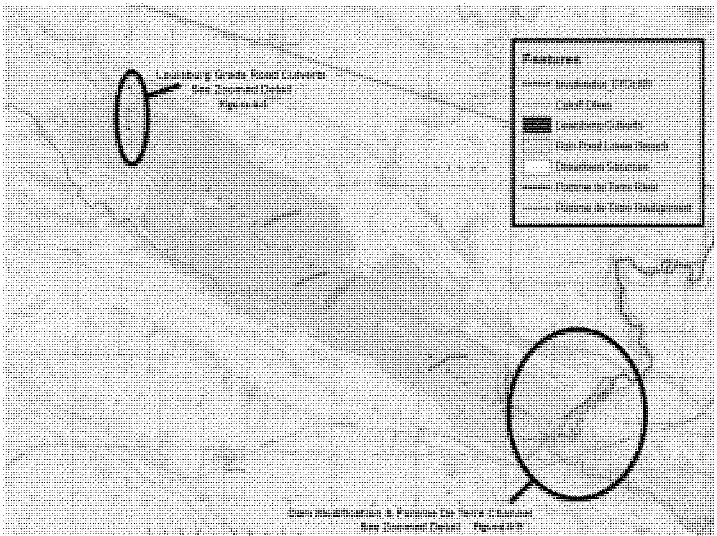


Figure 4-13. Location of potential rock breakwater islands (red) in Marsh Lake.

The rock islands would be constructed of local rock (quarry scrap and from farm fieldstone piles, not "mined" from native prairie areas). The rock islands would likely be built during winter when the lake is drawn down. The rock islands would be built to a top elevation of 940.3 ft, with a top width of 5 ft and side slopes of 3 to 1. Breakwater A (northernmost) would be 2647 ft long. Breakwater B (middle) would be 2153 feet long, and Breakwater C (southernmost) would be 2466 feet long. A total of 41,045 cubic yards of rock would be used to construct the breakwater islands.

4.1.12 Construct Exclosures to Prevent Grazing and Plant Submersed Aquatic Vegetation

Submersed aquatic vegetation can be planted in shallow lakes where the seed bank is exhausted or propagules are scarce. Seeds and propagules can be obtained from commercial nurseries or harvested from the wild. After seeds and propagules have been planted, they require protection from grazing. Exclosures are typically netting suspended from stakes to exclude carp. Once sufficient area of submersed aquatic vegetation is established, the exclosures can be removed and the vegetation cover may expand.

4.2 Screening of the Alternative Measures

Identified alternative measures must be evaluated in their effectiveness in achieving planning objectives while simultaneously complying with administrative, policy, legal and environmental constraints. From Section 3, objectives and constraints were identified as follows:

Objectives		Constraints
1. Reduced sediment loading to Marsh Lake over the 50-year period of analysis		1. The planning process must be consistent with all applicable Federal laws, Executive Orders, Agency Regulations and other applicable policy.
2. Restored natural fluctuations to the hydrologic regime of Marsh Lake over the 50-year period of analysis		
3. Restored geomorphic and floodplain processes to the Pomme de Terre River over the 50-year period of analysis		2. The formulation of alternative measures should avoid, to the greatest extent possible, the reduction of the flood damage reduction benefits provided by the dams.
4. Reduced sediment resuspension within Marsh Lake over the 50-year period of analysis		
5. Increased extent, diversity and abundance of emergent and submersed aquatic plants within Marsh Lake over the 50-year period of analysis		3. In its existing condition, Marsh Lake and the Pomme de Terre River provide functional habitat for a number of species. A universal constraint in the planning of ecosystem restoration projects is the maxim that the restoration activities should not degrade, but rather seek to improve, the existing function of the ecosystem from its current state. Consideration of the potential adverse impacts to species within the project area therefore imposes constraints on the development of alternative measures. Specific biotic considerations include: a. American Pelicans – a colony of nesting and breeding pelicans inhabits Marsh Lake during the summer months. Pelicans seek refuge on islands in the lake. Changes to water levels within the lake should minimize the impact on the isolation of these islands. b. Mussels – A diverse mussel community exists within the lower reaches of the Pomme de Terre River. Consideration of project alternatives should minimize the impacts to this community and its future viability. c. Fish Community – while the community is primarily dominated by common carp (an invasive species), Lac qui Parle and Marsh Lake also support communities of native fish. Changes to water levels resulting from alternative measures must minimize the negative impact on the native fish community, particularly valuable northern pike spawning habitat in the upper end of Marsh Lake.
6. Increased availability of waterfowl habitat within Marsh Lake over the 50-year period of analysis		
7. Restored aquatic habitat connectivity between Marsh Lake, the Pomme de Terre River and Lac Qui Parle over the 50-year period of analysis		
8. Reduced abundance of aquatic invasive fish species within Marsh Lake over the 50-year period of analysis		
9. Increased diversity and abundance of native fish within Marsh Lake and the Pomme de Terre River over the 50-year period of analysis		

Not all the potential alternative measures identified can or should be implemented in the Marsh Lake Ecosystem Restoration project. In addition to the objectives and constraints, three screening criteria were used to identify the alternative management measures retained for further consideration:

1) Could the management action be implemented as part of the Marsh Lake Project?
2) Would the management action be ecologically effective?
3) Would the management action be practicable from an engineering perspective?

Table 4-2 Assessment of the viability of the alternative measures.

Alternative Measures	Can be Implemented as part of Marsh Lake Project?	Ecologically Effective?	Practicable from Engineering Perspective?	Retain for Further Consideration?
No Action	Yes	No	Yes	Yes (for comparison with other alternatives)
Watershed BMPs	No	Yes	Yes	No
Wetland restorations in watershed	No	Yes	Yes	No
Streambank stabilization in watershed	No	Yes	Yes	No
Restore Pomme de Terre River to its former channel	Yes	Yes	Yes	Yes
Modify Marsh Lake Dam to attain target water levels/construct fishway	Yes	Yes	Yes	Yes
Drawdowns to restore emergent aquatic plants, control carp, modify Marsh Lake Dam	Yes	Yes	Yes	Yes
Install gated culverts Louisburg Grade Road	Yes	Yes	Yes	Yes
Install gated culverts and pump system in abandoned fish pond	Yes	No	No	No
Breach dike on abandoned fish pond	Yes	Yes	Yes	Yes
Breach or remove Marsh Lake Dam	Yes	Yes	No	No
Construct islands in Marsh Lake	Yes	Yes	Yes	Yes
Construct exclosures, plant submersed aquatic plants	Yes	Potentially	No	No

No action to restore the Marsh Lake ecosystem continues to impose unnaturally high water levels with only passive water level variability, relying on droughts to reduce inflows to zero and lower water level in Marsh Lake below the level of the fixed crest weir. This alternative measure would not meet the project objectives. It will be retained for further consideration because it is part of the without-project future baseline condition.

A variety of watershed BMPs can be implemented to moderate the hydrologic regime and reduce sediment and nutrient loading to Marsh Lake and Lac qui Parle. These are all actions that can and hopefully will be implemented by private landowners, other agencies and organizations under other programs. These alternative measures are being evaluated in the Minnesota River Basin Integrated Watershed Study. These alternative measures will not be retained for further consideration in the Marsh Lake project. They are actions that extend throughout the Upper Minnesota River Basin and are beyond the scope of the Marsh Lake project.

Lowering the water level within the abandoned fish pond area to below the level of Lac qui Parle would require pumping. Given the small size (10 acres) of this area, lack of DNR interest in active water level management in this area and the relatively high cost of pumps and operation and maintenance, this alternative measure has been dropped from further consideration.

Removing Marsh Lake dam would continuously lower the water level of Marsh Lake, allowing it to fluctuate along with the water level in Lac qui Parle reservoir. Much of Marsh Lake would become dewatered, reverting to wet meadow and marsh with the Minnesota River channel running through it. The potential for extensive areas of emergent and submersed aquatic vegetation providing food for migratory waterfowl would be significantly reduced. The colonial waterbird nesting islands would become vulnerable to predation and the colonial waterbirds would have restricted foraging area. In its current state, the Marsh Lake Dam does provide a minor benefit to flood damage reduction by storing the head of minor flooding in the upstream portion of the reservoir. Removing the hydraulic constriction of the Marsh Lake dam would reduce the head and storage upstream and would have the potential to increase the risk of downstream flooding damages. For these reasons, this alternative measure was dropped from further consideration.

Constructing exclosures to prevent carp grazing and planting submersed aquatic plants would be difficult in Marsh Lake due to fluctuating water levels and the wind and wave conditions that occur there. A sufficiently abundant seed and propagule bank for sago pondweed is present that allows abundant growth in years when growing conditions permit, so the seed bank is not a problem. For these reasons, this alternative measure was dropped from further consideration.

The alternative measures retained for further consideration (Table 4-3) derive from the ecosystem objectives for the project and are considered promising for implementation; potentially ecologically effective and practicable from an engineering perspective. Estimated costs of these alternative measures are provided in Table 4-3 and in Appendix G. The alternative measures will be combined into the alternative plans.

Table 4-2. Alternative measures retained for further consideration.

1) No Action
2) Restore Pomme de Terre River to its former channel
3) Modify Marsh Lake Dam to attain target water levels, construct fishway
4) Construct a drawdown water control structure to enable water level drawdowns and restore aquatic plants
5) Install gated culverts in Louisburg Grade Road
6) Breach dike at abandoned fish pond
7) Construct islands in Marsh Lake

Table 4-3. Costs of the alternative measures.

Alternative Measure Number	Alternative Measures	Net Benefit (AAHU)	First Costs of Construction	O&M Cost	Planning, Engineering & Design (PED)	Construction Management (CM)	Total First Project Costs	Average Annual Costs
1	No Action	0	$ -	$ -	$ -	$ -	$ -	$ -
2	Restore Pomme de Terre River to its former channel	6567	$ 3,448,212	$ 11,508	$ 387,945	$ 193,973	$ 4,030,130	$ 203,588
3	Modify Marsh Lake Dam to attain target	483	$ 1,399,695	$ 7,245	$ 154,433	$ 77,216	$ 1,631,344	$ 85,382
4	Construct drawdown water control structure	725	$ 2,594,217	$ 13,503	$ 278,993	$ 139,496	$ 3,012,706	$ 157,782
5	Install gated culverts in Louisburg Grade Road	610	$ 448,902	$ 800	$ 52,815	$ 26,408	$ 528,125	$ 26,105
6	Breach dike at abandoned fish pond	5	$ 6,426	$ 50	$ 870	$ 435	$ 7,731	$ 421
7	Construct islands in Marsh Lake	239	$ 4,006,254	$ 20,376	$ 448,875	$ 224,438	$ 4,679,567	$ 244,535

4.3 Alternative Plans

Alternative plans are combinations of alternative measures that would contribute to attaining the planning objectives. A stand alone measure is an alternative measure that can be implemented independently of others, resulting in some positive amount of ecosystem restoration output. Optional measures are those measures that would have limited utility by themselves, but can be implemented with other measures.

4.3.1 Stand Alone Measures

Measure 1 – No Action

The Corps is required to consider the option of "No Action" as one of the alternatives. With the No Action plan, which is synonymous with the "Without Project Condition," we assume that no project would be implemented by the Federal Government or by local interests to achieve the planning objectives. The No Action plan forms the basis from which all other alternative plans are measured.

Measure 2 – Restore the Pomme de Terre River to its former channel

This is a stand-alone measure that could be implemented independently of other restoration alternatives. Earthen berms would be constructed to re-route the river into its former channel both upstream and downstream of the Marsh Lake Dam access road embankment. This alternative would include a bridge over the river to maintain access to the Marsh Lake Dam and monitoring of the mussel community as described in Section 4.1.4 above.

Measure 3 - Modify Marsh Lake Dam to attain target water levels, construct fishway

This is a stand-alone measure that could be implemented independently of other restoration alternatives. Marsh Lake Dam would be modified with a fixed-crest weir fishway that would allow passive attainment of target water levels in most years and also allow continuous fish passage between Lac qui Parle and Marsh Lake.

Measure 4 – Construct a drawdown water control structure in Marsh Lake Dam

This is a stand-alone measure that could be implemented independently of other restoration alternatives. Marsh Lake Dam would have to be modified with a water control structure to enable water level management. Growing season drawdowns to elevation 936.0 ft would be done to encourage reestablishment of emergent aquatic plants and to increase the extent of submersed aquatic plants, particularly sago pondweed, an important source of forage for waterfowl. Following growing season drawdowns, winter drawdowns to elevation 935.0 ft could be implemented to reduce carp abundance.

Measure 5 – Install gated culverts in Louisburg Grade Road

. Installing stoplog control structures on the Louisburg Grade Road culverts would enable holding water in upper Marsh Lake in years when a growing season drawdown was conducted, allowing northern pike to successfully spawn in the flooded marsh vegetation and the young to grow into juveniles. Implementation of this measure is dependent on the construction of a drawdown structure and would only be effective in drawdown years on the lake. The measure is considered stand alone, but will only be combined with Alternative Plan combinations that include the drawdown structure for the purpose of plan formulation.

Measure 6 – Breach dike at abandoned fish pond

This is a stand-alone measure that could be implemented independently of other restoration alternatives. Breaching the fish pond dike on the downstream side of the Marsh Lake Dam would provide connectivity between the fish pond area and the upper end of Lac qui Parle, allowing native floodplain vegetation to become established and providing seasonally variable habitat for fish and shorebirds.

Measure 7 – Construct islands in Marsh Lake

This is a stand-alone measure that could be implemented independently. Constructing islands to break up wave action and reduce sediment resuspension would improve conditions for submersed aquatic plant growth. Although this is a stand-alone measure, it would be best to construct islands in Marsh Lake in conjunction with growing season and winter drawdowns (Measure 4) and modifying Marsh Lake Dam to attain target water levels (Measure 3). Growing season drawdowns would consolidate lake bed sediment, reducing sediment resuspension. Winter drawdowns would reduce carp abundance and grazing on submersed aquatic plants.

5. Optimization and Best Buy Analysis

Environmental plan evaluation consists of a comparison of the environmental outputs and the economic costs of alternative plans. The cost effectiveness and incremental cost analysis procedures provide a framework to assist in environmental plan evaluation. The following analysis was accomplished using the planning methodology incorporated in the Institute of Water Resources Cost Effectiveness and Incremental Cost Analysis program (IWR-PLAN). Combinations of solutions were derived and a total cost and total output is calculated for each combination. The program then conducts cost effectiveness analysis; first identifying the least cost combination for every possible level of output, and then identifying the cost effective set of combinations by screening out plans where more output could be provided by another combination at the same or less cost. Once the cost effective set of combinations is identified, the program calculates the incremental cost and incremental output of moving from each combination to the next larger combination. The program also identifies the subset of the cost effective set which is the most efficient in production, or "best-buys", as scale increases from the smallest to the largest combination.

Alternatives evaluated include the no action alternative and various combinations of restoration measures. The ecosystem output variable is stated in average annual habitat units (AAHU). Project outputs were determined by estimating the additional amount of enhanced Marsh Lake aquatic habitat, Marsh Lake emergent marsh habitat, Pomme de Terre River aquatic habitat, and floodplain wetland habitat that would be provided by each alternative using a Habitat Evaluation Procedures (HEP) analysis (Appendix E).

Representative species and guilds used in the HEP analysis were diving ducks for Marsh Lake aquatic habitat, walleye for Lac qui Parle and Pomme de Terre River aquatic habitat, northern pike for Lac qui Parle and upper Marsh Lake aquatic habitat and great blue heron for the abandoned fish pond wetland habitat. U.S. Fish and Wildlife Service "Blue Book" models and an Upper Mississippi River diving duck habitat model were used in the HEP analysis No relative value weighting of the habitat type areas potentially affected by the Marsh Lake project was conducted. Details of the HEP analysis are provided in Appendix E.

Cost estimates for the alternative plans were based on October 2011 price levels. Details of the cost estimate are provided in Appendix G. The first costs of implementation include detailed design, contracting, construction, planting, and monitoring. Recurring operation and maintenance activities following construction and habitat restoration were estimated over the 50-year project life and included in the cost estimate. Average annual costs were calculated by multiplying the first costs with operation and maintenance (OMRR&R) costs by an Interest and Amortization Factor for 4 1/8 percent (0.04125) over the 50 year period of analysis.

Plan formulation through IWR-Plan generated 48 alternative plans. Table 5 -1 presents the alternative plan combinations and Table 5-2 presents individual alternative measure average annual cost estimates at March 2011 price levels, as well as the estimated benefits (in average annual habitat units, AAHU'S). Alternative plans range from the no action alternative with no costs and no benefits to the 48th combination (identified as Alternative Plan 5) that has an average annual cost of $717,831with benefits of 8,508 AAHU's.

Table 5-1. Alternative plans with average annual benefits and average annual costs

No.	Restore Pomme de Terre	Modify Marsh Lake Dam	Drawdown Structure	Louisburg Grade Road Gated Culverts	Modify Abandoned Fish Pond	Construct Islands in Marsh Lake		Average Annual Habitat Units (AAHU)		Average Annual Costs		Average Costs per AAHU	Best Buy Plan
1								0		$ -		$ -	*
2					X			5		$ 421		$ 84.20	
3						X		239		$ 244,535		$ 1,023.16	
4					X	X		244		$ 244,956		$ 1,003.92	
5		X						483		$ 85,382		$ 176.77	
6		X			X			488		$ 85,803		$ 175.83	
7		X				X		722		$ 329,917		$ 456.95	
8			X					725		$ 157,782		$ 217.63	
9		X			X	X		727		$ 330,338		$ 454.39	
10			X		X			730		$ 158,203		$ 216.72	
11			X			X		964		$ 402,317		$ 417.34	
12			X		X	X		969		$ 402,738		$ 415.62	
13		X	X					1208		$ 243,164		$ 201.29	
14		X	X		X			1213		$ 243,585		$ 200.81	
15		X	X			X		1326		$ 487,699		$ 367.80	
16		X	X		X	X		1331		$ 488,120		$ 366.73	
17			X	X				1335		$ 183,887		$ 137.74	
18			X	X	X			1340		$ 184,308		$ 137.54	
19			X	X		X		1574		$ 428,422		$ 272.19	
20			X	X	X	X		1579		$ 428,843		$ 271.59	
21		X	X	X				1818		$ 269,269		$ 148.11	
22		X	X	X	X			1823		$ 269,690		$ 147.94	
23		X	X	X		X		1936		$ 513,804		$ 265.39	
24		X	X	X	X	X		1941		$ 514,225		$ 264.93	
25	X							6567		$ 203,588		$ 31.00	*
26	X				X			6572		$ 204,009		$ 31.04	*
27	X					X		6806		$ 448,123		$ 65.84	
28	X				X	X		6811		$ 448,544		$ 65.86	
29	X	X						7050		$ 288,970		$ 40.99	
30	X	X			X			7055		$ 289,391		$ 41.02	
31	X	X				X		7289		$ 533,505		$ 73.19	
32	X		X					7292		$ 361,370		$ 49.56	
33	X	X			X	X		7294		$ 533,926		$ 73.20	
34	X		X		X			7297		$ 361,791		$ 49.58	
35	X		X			X		7531		$ 605,905		$ 80.45	
36	X		X		X	X		7536		$ 606,326		$ 80.46	
37	X	X	X					7775		$ 446,752		$ 57.46	
38	X	X	X		X			7780		$ 447,173		$ 57.48	
39	X	X	X			X		7893		$ 691,287		$ 87.58	
40	X	X	X		X	X		7898		$ 691,708		$ 87.58	
41	X		X	X				7902		$ 387,475		$ 49.04	
42	X		X	X	X			7907		$ 387,896		$ 49.06	*
43	X		X	X		X		8141		$ 632,010		$ 77.63	
44	X		X	X	X	X		8146		$ 632,431		$ 77.64	
45	X	X	X	X				8385		$ 472,857		$ 56.39	
46	X	X	X	X	X			8390		$ 473,278		$ 56.41	*
47	X	X	X	X		X		8503		$ 717,392		$ 84.37	
48	X	X	X	X	X	X		8508		$ 717,813		$ 84.37	*

Table 5-2. Cost and benefits (Average Annual Habitat Units) of alternative measures (October 2011 price levels).

Alternative Measure Number	Alternative Measures	Net Benefit (AAHU)	Total First Project Costs	Average Annual Costs	Annualized Cost (per AAHU)
1	No Action	0	$ -	$ -	$ -
2	Restore Pomme de Terre River to its former channel	6567	$ 4,030,130	$ 203,588	$ 31
3	Modify Marsh Lake Dam to attain target water levels, construct fishway	483	$ 1,631,344	$ 85,382	$ 177
4	Construct drawdown water control structure	725	$ 3,012,706	$ 157,782	$ 218
5	Install gated culverts in Louisburg Grade Road	610	$ 528,125	$ 26,105	$ 43
6	Breach dike at abandoned fish pond	5	$ 7,731	$ 421	$ 84
7	Construct islands in Marsh Lake	239	$ 4,679,567	$ 244,535	$ 1,023

Interest and Amoritization on Factor for 4-1/8% interest (0.04125) over the 50 year payment period.

To further refine the number of alternative plans remaining, criteria to distinguish the cost effectiveness of each alternative were established. The screening for cost effectiveness included the following:

- The same output level could be produced by another plan at less cost;
- A larger output level could be produced at the same cost; or
  A larger output level could be produced at less cost.

Five alternative plans (including the "No Action" alternative) emerged as cost-effective and were identified as "Best Buy" plans through incremental and cost effectiveness analysis using the Corps of Engineers IWR Planning Suite (Table 5-1, Figure 5-1). In the figure below, a blue best-fit straight line is included to identify the trend in cost-effective plans, while a red best-fit curve is included to illustrate the array of best buy plans within chart.

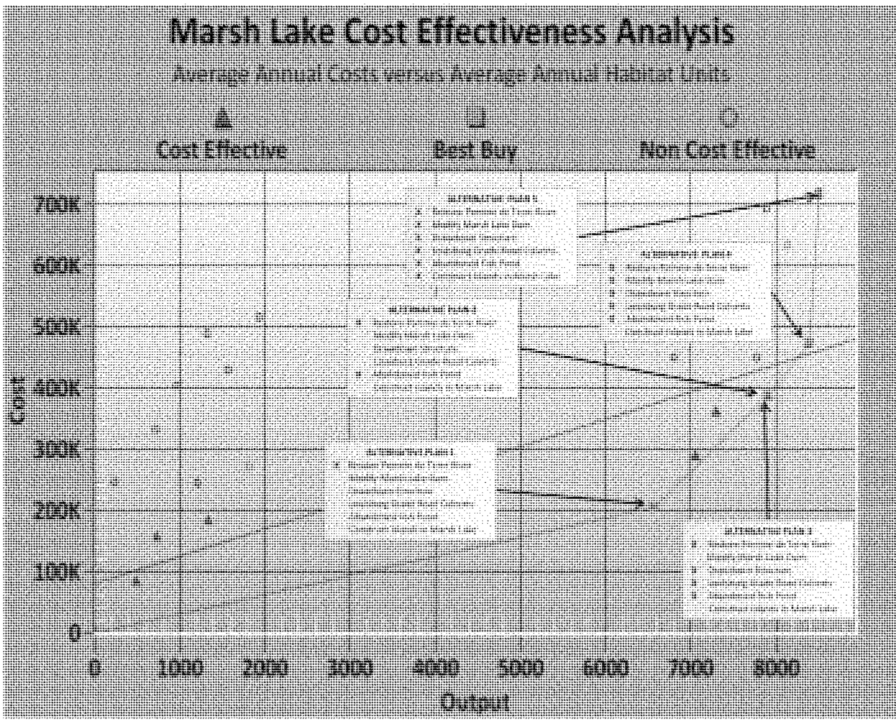


Figure 5-1 Results of incremental and cost effectiveness analysis of the alternative plans. Average annual costs (y-axis costs) versus average annual habitat units (x-axis benefits)

Figure 5-15 further highlights information included in Table 5-1 by illustrating the average annual cost per unit (cost of one AAHU) for each plan contrasted with the corresponding cumulative ecosystem benefits of each plan. Best Buy/Alternative Plans are specifically identified within the graph.

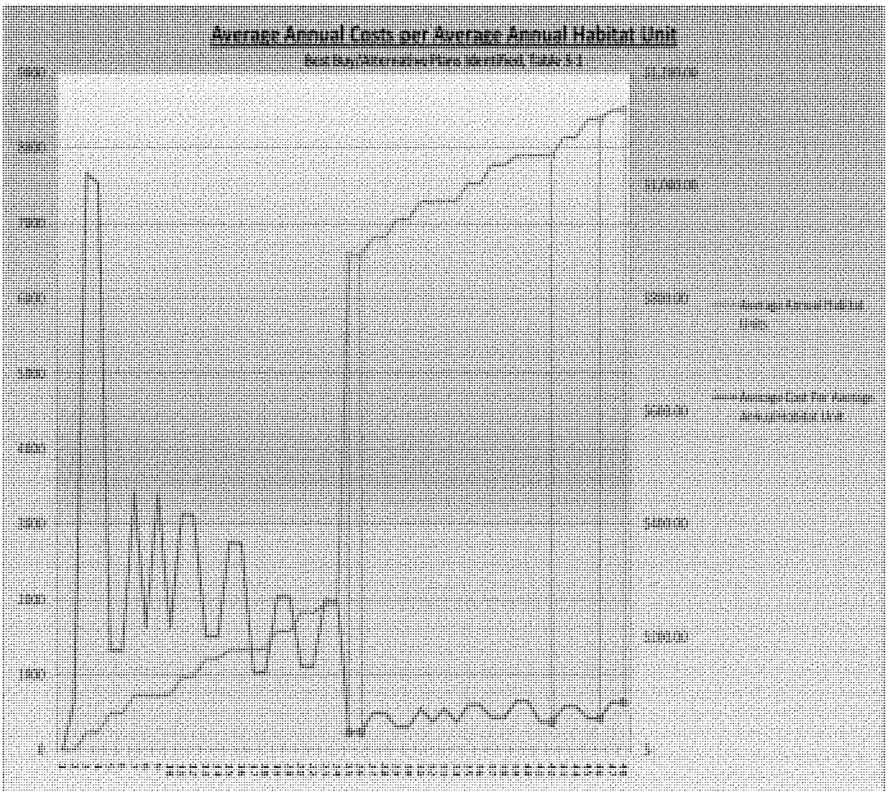


Figure 5-2 Average annual costs per average annual habitat units (Best Buy Plans Identified)

A best buy plan is a cost effective plan that has the greatest increase in output or benefit for the least increase in cost. Each cost effective plan was first compared to the no action alternative and ranked. This ranking provided the first best buy plan. From here, each remaining plan was compared to the first best buy plan and ranked. This analysis yielded the second best buy and so on. There can be multiple best buy plans and any of them can be chosen as the preferred alternative.

6. Evaluation and Comparison of Alternative Plans

6.1 Alternative Plans

The five best buy plans and the no action alternative are carried forward in the analysis and further described as alternative plans.

Alternative Plan 0 (IWR Formulated Plan #1): No Action

The no action alternative assumes that no project would be implemented by either the Corps or local interests to achieve the planning objectives. The no action alternative is synonymous with the without-project future condition.

Alternative Plan 1 (IWR Formulated Plan #25)

Alternative Plan 1 is the restoration of the Pomme de Terre River to its historic channel. The average annual cost of this plan is $203,588 and would result in 6,567 AAHU over 50 years.

Alternative Plan 2 (IWR Formulated Plan #26)

Alternative Plan 2 is a combination of restoration of the Pomme de Terre River described in Alternative Plan 1 with the addition of breaching the dike at the Abandoned Fish Pond in order to connect this area to the downstream area of Lac qui Parle. The average annual cost of this plan is $204,009 (average and would result in 6,572 AAHU over 50 years.

Alternative Plan 3 (IWR Formulated Plan #42)

Alternative Plan 3 is a combination of the restoration measures included in Alternative Plan 2 with the addition of a drawdown structure to lower lake levels periodically and construction of culverts with stoplogs at Louisburg Grade Road. The average annual cost of this plan is $387,896 and would result in 7,907 AAHU over 50 years.

Alternative Plan 4 (IWR Formulated Plan #46)

Alternative Plan 4 is a combination of Alternative 3 with the addition of modifying Marsh Lake Dam to meet target water levels and construct a fishway. The average annual cost of this plan is $473,278 and would result in 8,390 AAHU over 50 years.

Alternative Plan 5 (IWR Formulated Plan #48)

Alternative Plan 5 is a combination of all the alternative measures including constructing islands in Marsh Lake. The average annual cost of this plan is $717,813 and would result in 8508 AAHU over 50 years.

6.2 Evaluation of the Alternative Plans

The alternative plans are evaluated for their potential to contribute to achieving project objectives:

1. Reduced sediment loading to Marsh Lake over the 50-year period of analysis
2. Restored natural fluctuations to the hydrologic regime of Marsh Lake over the 50-year period of analysis
3. Restored geomorphic and floodplain processes to the Pomme de Terre River over the 50-year period of analysis
4. Reduced sediment resuspension within Marsh Lake over the 50-year period of analysis
5. Increased extent, diversity and abundance of emergent and submersed aquatic plants within Marsh Lake over the 50-year period of analysis
6. Increased availability of waterfowl habitat within Marsh Lake over the 50-year period of analysis
7. Restored aquatic habitat connectivity between Marsh Lake, the Pomme de Terre River and Lac Qui Parle over the 50-year period of analysis
8. Reduced abundance of aquatic invasive fish species within Marsh Lake over the 50-year period of analysis
9. Increased diversity and abundance of native fish within Marsh Lake and the Pomme de Terre River over the 50-year period of analysis

The narrative below discusses the degree to which the alternative plans would contribute to attaining the project objectives.

Objective 1: Reduced sediment and nutrient loading to Marsh Lake

Alternative Plan 0: No Action

The no-action plan would not meet this objective. Sediment and nutrient loading to Marsh Lake and Lac qui Parle would continue at high rates.

Alternative Plan 1: Restore the Pomme de Terre River to its Historic Channel

This alternative plan would significantly reduce sediment and nutrient loading to Marsh Lake. Sediment and nutrients conveyed by the Pomme de Terre River would enter the upper end of Lac qui Parle via the historic Pomme de Terre River delta. Much of the sediment and nutrient load would be retained in overbank areas in the floodplain, contributing to natural floodplain processes and reducing sediment and nutrient loading to Lac qui Parle.

Alternative Plan 2: Restore Pomme de Terre River to its Historic Channel + Breach Dike at Abandoned Fish Pond

This alternative plan would significantly reduce sediment and nutrient loading to Marsh Lake as described for Alternative Plan 1. In addition, breaching the abandoned fish pond dike would reconnect the fish pond area to the upper end of Lac qui Parle, providing the opportunity for retaining sediment and processing nutrients within the fish pond area.

Alternative Plan 3: Alternative Plan 2 + Drawdown Structure + Gated Culverts at Louisburg Grade Road

This alternative plan would significantly reduce sediment and nutrient loading to Marsh Lake as described for Alternative Plan 2. The drawdown structure would enable drawdowns on Marsh Lake to restore aquatic vegetation. Increased extent of aquatic vegetation would retain sediments and nutrients in Marsh Lake, reducing sediment and nutrient loading to Lac qui Parle. Stoplog structures under the Louisburg Grade Road would only be operated during years when Marsh Lake is drawn down to enable successful spawning by northern pike in upper Marsh Lake. This would have a minor positive contribution to Objective 1 by retaining sediment and nutrients in upper Marsh Lake during the years when Marsh Lake is drawn down.

Alternative Plan 4 – Alternative Plan 3 + Modify Marsh Lake Dam to Attain Target Water Levels and Construct Fishway

This alternative plan would significantly reduce sediment and nutrient loading to Marsh Lake as described for Alternative Plan 3. In addition, Modifying Marsh Lake Dam with a fishway would result in lower late summer and winter water levels in Marsh Lake. This would encourage aquatic vegetation in Marsh Lake, trapping sediment and nutrients in Marsh Lake, thereby reducing sediment and nutrient loading to Lac qui Parle.

Alternative Plan 5 – Alternative 4 + Construct Islands in Marsh Lake (All alternative measures)

This alternative plan would significantly reduce sediment and nutrient loading to Marsh Lake as described for Alternatives 4. Constructing islands in Marsh Lake would further promote aquatic vegetation in Marsh Lake, trapping sediment and nutrients in Marsh Lake, thereby reducing sediment and nutrient loading to Lac qui Parle.

Objective 2: Restored natural fluctuations the water level regime in Marsh Lake

Alternative Plan 0: No Action

The no action plan would not meet the objective of restoring a more natural water level regime in Marsh Lake.

Alternative Plan 1: Restore Pomme de Terre River to its Historic Channel

Restoring the Pomme de Terre River to its former channel would help restore a more natural water level regime in Marsh Lake by moderating water level fluctuations induced by storm runoff events in the Pomme de Terre River watershed. This would be a minor but positive effect. The fixed crest Marsh Lake Dam would continue to limit the low side of the water level regime in Marsh Lake.

Alternative Plan 2: Restore Pomme de Terre River to its Historic Channel + Breach Dike at Abandoned Fish Pond

This alternative plan would help restore a more natural water level regime in Marsh Lake as described for Alternative Plan 1. Breaching the dike on the abandoned fish pond would have no effect on the water level regime in Marsh Lake.

Alternative Plan 3: Alternative Plan 2 + Drawdown Structure + Gated Culverts at Louisburg Grade Road

This alternative would meet the objective of restoring a more natural water level regime in Marsh Lake by enabling drawdowns of Marsh Lake to consolidate sediment and restore emergent aquatic plants. The drawdowns would simulate natural low water events that occurred on Marsh Lake prior to impoundment. The gated culverts at the Louisburg Grade Road would allow successful spawning of northern pike in upper Marsh Lake in years when Marsh Lake is drawn down. Northern pike spawn in flooded emergent marsh vegetation.

Alternative Plan 4 – Alternative Plan 3 + Modify Marsh Lake Dam to Attain Target Water Levels and Construct Fishway

This Alternative Plan would meet the objective of restoring a more natural water level regime as described for Alternative Plan 3. In addition, modifying Marsh Lake Dam with a fishway would result more natural lower late summer and winter water levels in Marsh Lake nearly every year through passive water level management.

Alternative Plan 5 – Alternative 4 + Construct Islands in Marsh Lake (All alternative measures)

This Alternative Plan would meet the objective of restoring a more natural water level regime as described for Alternative Plan 4 above. Constructing islands would have no effect on the Marsh Lake water level regime, however islands would be effective in reducing wind-driven waves and sediment resuspension, thereby promoting growth of submersed aquatic plants (Objectives 4 and 5).

Objective 3: Restored natural geomorphic and floodplain processes in Pomme de Terre River

Alternative Plan 0: No Action

The no-action plan would not restore geomorphic and floodplain processes in the Pomme de Terre River.

Alternative Plan 1: Restore Pomme de Terre River to its Historic Channel

This alternative plan would restore geomorphic and floodplain processes in the Pomme de Terre River and its delta at its historic confluence with the Minnesota River in upper Lac qui Parle. The Pomme de Terre River would flow through its former channel in its confluence with the Minnesota River, resuming the fluvial processes that form the complex channel and floodplain habitats in that area. Sediment conveyed by the river would be deposited overbank in the delta area during higher discharge events, enriching floodplain soils, enhancing floodplain habitats and reducing sediment and nutrient loading into Lac qui Parle.

Alternative Plan 2: Restore Pomme de Terre River to its Historic Channel + Breach Dike at Abandoned Fish Pond

This alternative plan would restore geomorphic and floodplain processes as described for Alternative Plan 1. In addition, breaching the dike at the abandoned fish pond would reconnect the fish pond area with the upper end of Lac qui Parle, enabling movement of water, materials and organisms between that area and the rest of the floodplain. Although not directly contributing to restoring geomorphic and floodplain processes in the Pomme de Terre River, it would restore floodplain processes in upper Lac qui Parle across the Minnesota River from the Pomme de Terre River confluence.

Alternative Plan 3: Alternative Plan 2 + Drawdown Structure + Gated Culverts at Louisburg Grade Road

This alternative plan would also restore geomorphic and floodplain processes in the Pomme de Terre River and its delta as described for Alternative Plan 2.

Alternative Plan 4 – Alternative Plan 3 + Modify Marsh Lake Dam to Attain Target Water Levels and Construct Fishway

This alternative plan would also restore geomorphic and floodplain processes in the Pomme de Terre River and its delta as described for Alternative Plan 2.

Alternative Plan 5 – Alternative 4 + Construct Islands in Marsh Lake (All alternative measures)

This alternative plan would also restore geomorphic and floodplain processes in the Pomme de Terre River and its delta as described for Alternative Plan 2.

Objective 4: Reduced sediment resuspension in Marsh Lake

Alternative Plan 0: No Action

The no action alternative would not meet the objective for reduced sediment resuspension in Marsh Lake.

Alternative Plan 1: Restore Pomme de Terre River to its Historic Channel

Alternative Plan 1 would not meet the objective for reduced sediment resuspension in Marsh Lake.

Alternative Plan 2: Restore Pomme de Terre River to its Historic Channel + Breach Dike at Abandoned Fish Pond

Alternative Plan 2 would not meet the objective for reduced sediment resuspension in Marsh Lake.

Alternative Plan 3: Alternative Plan 2 + Drawdown Structure + Gated Culverts at Louisburg Grade Road

Alternative Plan 3 would contribute to achieving reduced sediment resuspension in Marsh Lake. Drawdowns would consolidate sediment and encourage the reestablishment of emergent aquatic vegetation which upon return to normal water levels would greatly reduce wind fetch and sediment resuspension in Marsh Lake.

Alternative Plan 4 – Alternative Plan 3 + Modify Marsh Lake Dam to Attain Target Water Levels and Construct Fishway

Alternative Plan 4 would also contribute to achieving reduced sediment resuspension as described for Alternative Plan 3. In addition, modifying Marsh Lake Dam with a fishway would result more natural lower late summer and winter water levels in Marsh Lake nearly every year through passive water level management. This would encourage the establishment and persistence of emergent aquatic vegetation that would reduce wind fetch and sediment resuspension.

Alternative Plan 5 – Alternative 4 + Construct Islands in Marsh Lake (All alternative measures)

This alternative plan would greatly contribute to reducing sediment resuspension as described for Alternative Plan 4. In addition, rock wave barrier islands are very effective in reducing wind fetch, wave action and sediment resuspension and have been designed to optimally reduce wind fetch and wave action on Marsh Lake.

Objective 5: Increased extent, diversity and abundance of emergent and submersed aquatic plants in Marsh Lake

Alternative Plan 0: No Action

The no action plan would not meet this objective. Submersed aquatic plants would remain sparse and emergent vegetation would be limited to a narrow fringe around the shores.

Alternative Plan 1: Restore Pomme de Terre River to its Historic Channel

This alternative plan would contribute to increased submersed aquatic vegetation in Marsh Lake by reducing sediment loading from the Pomme de Terre River and by moderating the water level regime in Marsh Lake. Reduced sediment loading would reduce turbidity, allowing more underwater light necessary for submersed aquatic plant growth. A more natural water level regime would reduce periods of high water, also contributing to submersed aquatic plant growth.

Alternative Plan 2: Restore Pomme de Terre River to its Historic Channel + Breach Dike at Abandoned Fish Pond

Like Alternative Plan 1, this alternative plan would contribute to increased submersed aquatic vegetation in Marsh Lake. Breaching the dike in the abandoned fish pond may increase submersed aquatic plant growth in that area.

Alternative Plan 3: Alternative Plan 2 + Drawdown Structure + Gated Culverts at Louisburg Grade Road

Alternative Plan 3 would greatly contribute to increased aquatic vegetation in Marsh Lake. In addition to the positive effects of re-routing the Pomme de Terre River on submersed aquatic plants in Marsh Lake as described for Alternative Plan 2, drawdowns would enable reestablishment of emergent aquatic plants. Drawdowns consolidate bottom sediment, reducing sediment resuspension and allowing the seeds of emergent aquatic plants to germinate in the dewatered area. Upon return to normal water levels, the increased extent of emergent aquatic plants would reduce wind fetch and sediment resuspension, allowing more submersed aquatic plant growth. Winter drawdowns would reduce abundance of common carp that graze on submersed aquatic plants.

Alternative Plan 4 – Alternative Plan 3 + Modify Marsh Lake Dam to Attain Target Water Levels and Construct Fishway

Alternative Plan 4 would increase the extent and abundance of aquatic vegetation in Marsh Lake as described for Alternative Plan 3. In addition, modifying Marsh Lake Dam with a fishway would result in more natural lower late summer and winter water levels in Marsh Lake nearly every year through passive water level management. This would encourage the establishment and persistence of emergent aquatic vegetation.

Alternative Plan 5 – Alternative 4 + Construct Islands in Marsh Lake (All alternative measures)

This alternative plan would increase the extent and abundance of aquatic vegetation as described for Alternative Plan 4. In addition, the rock wave barrier islands would physically reduce wind fetch, wind-driven wave action and sediment resuspension over much of Marsh Lake, greatly contributing to growth of submersed aquatic plants.

Objective 6: Increased availability of waterfowl habitat within Marsh Lake

Alternative Plan 0: No Action

The no action plan would not contribute to increased waterfowl habitat in Marsh Lake.

Alternative Plan 1: Restore Pomme de Terre River to its Historic Channel

This alternative plan would contribute to increased availability of waterfowl habitat by increasing submersed aquatic vegetation needed by fall migrating waterfowl. Submersed aquatic vegetation would increase due to reduced sediment loading from the Pomme de Terre River and a moderated the water level regime in Marsh Lake.

Alternative Plan 2: Restore Pomme de Terre River to its Historic Channel + Breach Dike at Abandoned Fish Pond

This alternative plan would contribute to increased availability of waterfowl habitat as described for Alternative Plan 1. In addition, breaching the dike on the abandoned fish pond would restore habitat connectivity with the rest of Lac qui Parle, providing a shallow foraging area for fish-eating waterfowl.

Alternative Plan 3: Alternative Plan 2 + Drawdown Structure + Gated Culverts at Louisburg Grade Road

This alternative plan would greatly contribute to increased availability of waterfowl habitat as described for Alternative Plan 2. In addition, drawdowns would enable reestablishment of emergent aquatic plants. Increased extent of emergent aquatic plants would provide sheltered shallow water for nesting waterfowl and for migrating waterfowl. Drawdowns consolidate bottom sediment, reducing sediment resuspension and allowing more submersed aquatic plant growth. Increased submersed aquatic vegetation like sago pondweed and water celery would provide important food for fall migrating waterfowl.

Alternative Plan 4 – Combination of Alternative Plan 3 + Modify Marsh Lake Dam to Attain Target Water Levels and Construct Fishway

This alternative plan would greatly contribute to increased availability of waterfowl habitat as described for Alternative Plan 3. In addition, modifying Marsh Lake Dam with a fishway would result in more natural lower late summer and winter water levels in Marsh Lake nearly every year through passive water level management. This would encourage the establishment and persistence of emergent aquatic vegetation, providing increased habitat and food for waterfowl.

Alternative Plan 5 – Alternative 4 + Construct Islands in Marsh Lake (All alternative measures)

This would be the most ecologically effective plan for restoring waterfowl habitat in Marsh Lake. In addition to the benefits of Alternative Plan 4, the rock wave barrier islands would allow more consistent growth of submersed aquatic vegetation and would provide wave-sheltered areas for resting migrating waterfowl.

Objective 7: Restored habitat connectivity for fish to migrate between Marsh Lake, the Pomme de Terre River and Lac Qui Parle

Alternative Plan 0: No Action

The no action plan would not improve habitat connectivity for fish.

Alternative Plan 1: Restore Pomme de Terre River to its Historic Channel

Alternative Plan 1 would significantly improve habitat connectivity for fish between Lac qui Parle and the Pomme de Terre River. Walleye, white bass, white suckers, shorthead redhorse and many other species would be able to migrate up the Pomme de Terre River to high quality spawning and nursery habitat. This alternative plan would not improve aquatic habitat connectivity between Lac qui Parle and Marsh Lake.

Alternative Plan 2: Restore Pomme de Terre River to its Historic Channel + Breach Dike at Abandoned Fish Pond

As with Alternative Plan 1, this alternative plan would improve habitat connectivity for fish between Lac qui Parle and the Pomme de Terre River, but it would not improve fish passage opportunity between Lac qui Parle and Marsh Lake. Breaching the dike on the abandoned fish pond would allow fish access into the abandoned fish pond from Lac qui Parle.

Alternative Plan 3: Alternative Plan 2 + Drawdown Structure + Gated Culverts at Louisburg Grade Road

Alternative Plan 3 would significantly improve habitat connectivity for fish between Lac qui Parle and the Pomme de Terre River as described for Alternative Plan 2. In addition, the gated culverts at the Louisburg Grade Road would allow northern pike in Marsh Lake to successfully spawn in upper Marsh Lake in years when the lake is drawn down.

Alternative Plan 4 – Combination of Alternative Plan 3 + Modify Marsh Lake Dam to Attain Target Water Levels and Construct Fishway

Alternative Plan 4 would significantly improve habitat connectivity for fish between Lac qui Parle, the Pomme de Terre River and Marsh Lake. The fishway in the Marsh Lake Dam would provide year-round aquatic habitat connectivity between Lac qui Parle and Marsh Lake.

Alternative Plan 5 – Alternative 4 + Construct Islands in Marsh Lake (All alternative measures)

This alternative plan would significantly improve fish habitat connectivity as described for Alternative Plan 4. The rock wave barrier islands in Marsh Lake would not impede fish movements.

Objective 8: Reduced abundance of aquatic invasive fish species in Marsh Lake

Alternative Plan 0: No Action

The no action plan would not contribute to increased abundance of native fish in Marsh Lake. Common carp would remain abundant.

Alternative Plan 1: Restore Pomme de Terre River to its Historic Channel

Alternative Plan 1 would contribute to increased abundance of native fish and reduced abundance of common carp in Marsh Lake. Reduced sediment loading would improve water clarity in Marsh Lake to the benefit of native fish. Diverting the Pomme de Terre River would reduce winter dissolved oxygen in Marsh Lake, reducing over-winter survival of common carp. Native fish like northern pike are better adapted to winter hypoxic conditions than are carp.

Alternative Plan 2: Restore Pomme de Terre River to its Historic Channel + Breach Dike at Abandoned Fish Pond

Alternative Plan 2 would contribute to increased abundance of native fish and reduced abundance of common carp as described for Alternative Plan 1. In addition, breaching the dike in the abandoned fish pond would add 15 acres of shallow aquatic habitat accessible by fish in Lac qui Parle.

Alternative Plan 3: Alternative Plan 2 + Drawdown Structure + Gated Culverts at Louisburg Grade Road

Alternative Plan 3 would contribute to increased abundance of native fish and reduced abundance of common carp as described for Alternative Plan 2. In addition, Marsh Lake drawdowns would restore aquatic vegetation and reduce carp abundance in Marsh Lake, increasing water clarity and providing increased food and cover for native fish. Winter drawdowns would be very effective in reducing the abundance of carp in Marsh Lake. The gated culverts under the Louisburg Grade Road would enable successful spawning by northern pike in upper Marsh Lake in years when the lake is drawn down.

Alternative Plan 4 – Combination of Alternative Plan 3 + Modify Marsh Lake Dam to Attain Target Water Levels and Construct Fishway

Alternative Plan 4 would contribute to increased abundance of native fish and reduced abundance of common carp as described for Alternative Plan 3. In addition, the fishway in the Marsh Lake Dam would provide year-round aquatic habitat connectivity between Lac qui Parle and Marsh Lake to the benefit of native fish populations.

Alternative Plan 5 – Alternative 4 + Construct Islands in Marsh Lake (All alternative measures)

Alternative Plan 5 would contribute to increased abundance of native fish and reduced abundance of common carp as described for Alternative Plan 4. The rock wave barrier islands would not impede fish movement in Marsh Lake and would provide hard substrate for macroinvertebrates that fish prey upon.

Objective 9: Increased diversity and abundance of native fish within Marsh Lake the Pomme de Terre River

Alternative Plan 0: No Action

The no action plan would not contribute to increased abundance of native fish in Marsh Lake or the Pomme de Terre River.

Alternative Plan 1: Restore Pomme de Terre River to its Historic Channel

Alternative Plan 1 would increase the diversity and abundance of native fish in the Pomme de Terre River. Walleye, white bass, white suckers, shorthead redhorse and many other species would be able to migrate up the Pomme de Terre River to high quality spawning and nursery habitat. Reliable access to high quality spawning habitat should improve reproductive success and contribute to increased migratory fish populations.

Alternative Plan 2: Restore Pomme de Terre River to its Historic Channel + Breach Dike at Abandoned Fish Pond

This alternative measure would increase diversity and abundance of fish in the Pomme de Terre River as described for Alternative 1. Breaching the dike at the abandoned fish pond would provide fish access to that area from Lac qui Parle.

Alternative Plan 3: Alternative Plan 2 + Drawdown Structure + Gated Culverts at Louisburg Grade Road

Alternative Plan 3 would increase the diversity and abundance of native fish in the Pomme de Terre River as described for Alternative Plan 2.

Alternative Plan 4 – Alternative Plan 3 + Modify Marsh Lake Dam to Attain Target Water Levels and Construct Fishway

Alternative Plan 4 would increase the diversity and abundance of native fish in the Pomme de Terre River as described for Alternative Plan 2. Construction of a fishway in the Marsh Lake Dam would effectively expand the area of aquatic habitat accessible to Pomme de Terre River fish, contributing to more optimal foraging, growth, survival and population sizes.

Alternative Plan 5 – Alternative 4 + Construct Islands in Marsh Lake (All alternative measures)

Alternative Plan 5 would contribute to increased abundance of native fish in the Pomme de Terre River as described for Alternative Plan 4. The rock wave barrier islands would not impede fish movements and would provide hard substrate for macroinvertebrates that fish prey upon.

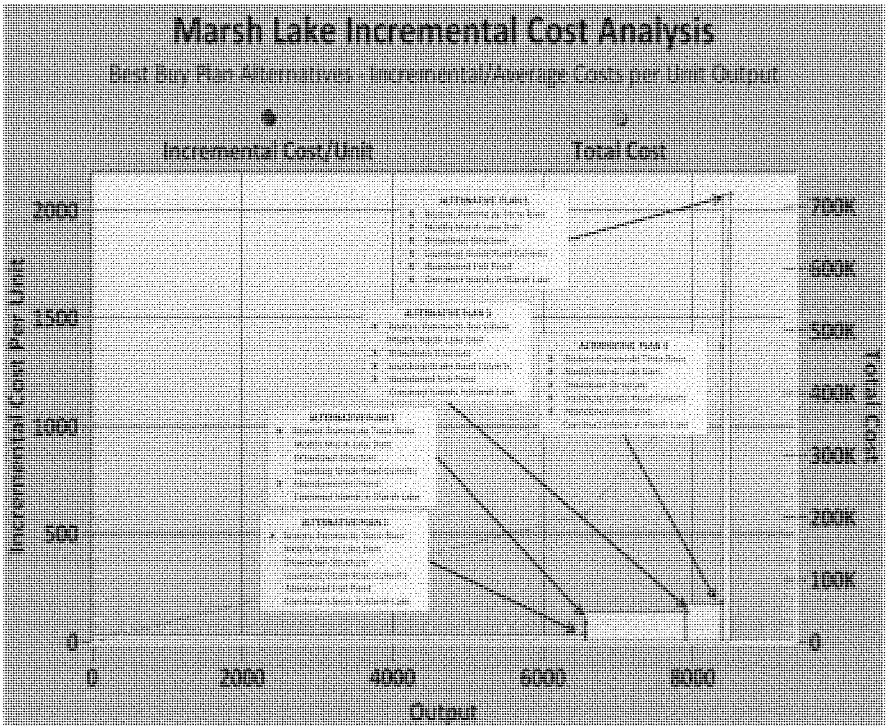
6.3 Alternative Plan Comparison: Incremental Cost Analysis

Incremental cost analysis compares the relative costs of alternative plans against each other. Incremental cost begins with the No Action Alternative and successively compares the cost per unit output of each plan to derive the additional benefit provided by each plan as well as the cost per unit incurred resulting from the selection of a given plan. The goal of this exercise is to identify which plans optimize efficiency of outputs in regards to cost. IWR Plan software is typically used for the purpose of this analysis. Results are included in Table 6-2 and Figure 6-1 below:

Table 6-2 Incremental costs of Best Buy/Alternative Plans

No.	Restore Pomme de Terre	Modify Marsh Lake Dam, Fishway	Drawdown Structure	Louisburg Grade Road Gated Culverts	Modify Abandoned Fish Pond	Construct Islands in Marsh Lake	Average Annual Habitat Units (AAHU)	Average Annual Costs	Average Costs per AAHU	Incremental Increase in Cost per AAHU
0							0	$ -	$ -	$ -
1	X						6567	$ 203,588	$ 31.00	$ 31.00
2	X				X		6572	$ 204,009	$ 31.04	$ 84.20
3	X		X	X	X		7907	$ 387,896	$ 49.06	$ 137.74
4	X	X	X	X	X		8390	$ 473,278	$ 56.41	$ 176.77
5	X	X	X	X	X	X	8508	$ 717,813	$ 84.37	$ 2,072.33

Figure 6-1. Incremental analysis of the Best Buy/Alternative plans (October 2011, price level).



Increment 1, Restore Pomme de Terre River to its Historic Channel

Restoring the Pomme de Terre River to its former channel would re-connect aquatic habitat between Lac qui Parle and the Pomme de Terre River and reduce a major source of sediment loading to Marsh Lake. This measure provides the single highest level of benefit at the lowest cost per increment. The costs per average annual habitat unit (AAHU) for this increment is $31.00 with a projected total benefit of 6567 AAHU. In terms of cost efficiency, Increment 1 provides the greatest benefits at the lowest costs.

Increment 2, Breach Dike at Abandoned Fish Pond

Increment 2 is the additional measure of breaching the abandoned fish pond dike. The incremental increase in costs per average annual habitat unit (AAHU) for this increment is $84.20 and a total cumulative benefit of 6572 AAHU.

Increment 3, Drawdown Structure + Gated Culverts at Louisburg Grade Road

Increment 3 is the construction of a stoplog water control structure to lower lake levels periodically and construction of culverts at Louisburg Grade Road. The incremental increase in costs per average annual habitat unit (AAHU) for this increment is $137.74 and a total cumulative benefit of 7907 AAHU.

Increment 4, Modify Marsh Lake Dam to Attain Target Water Levels and Construct Fishway

Increment 4 is the modification of the Marsh Lake dam for passive water level management as well as construction of a fishway. The incremental increase in costs per average annual habitat unit (AAHU) for this increment is $176.77 and a total cumulative benefit of 8390 AAHU.

Increment 5, Construct Islands in Marsh Lake

Increment 5 is the addition of breakwater islands in Marsh Lake in combination with the full array of alternatives. The incremental increase in costs per average annual habitat unit (AAHU) for this increment is $2072.33 and a total cumulative benefit of 8508 AAHU.

6.4 Completeness, Effectiveness, Efficiency, Acceptability

USACE ER 1105-2-100 states that the selected plan should meet "planning objectives and constraints and reasonably maximize environmental benefits while passing tests of cost effectiveness and incremental cost analysis, significance of outputs, acceptability, completeness, efficiency and effectiveness." These terms are defined as the following:

Completeness – the extent to which an alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of all planned effects.

Effectiveness – The extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities, as established in the planning objectives.

Efficiency – the extent to which an alternative plan is the most cost effective means of alleviating the specified problems and realizing the specified opportunities as established in the planning objectives, consistent with protecting the nation's environment.

Acceptability – the workability and viability of the alternative plan with respect to acceptance by state and local entities and the public compatibility with existing laws, regulations and public policies.

An ordered ranking of the five plans is included in Table 6-3. (1=Highest Rank, 5=Lowest Rank)

Table 6-3. Rank order of the Marsh Lake project alterative plans by completeness, effectiveness, efficiency and acceptability.

Ordered Ranking of Plan Alternatives					
	Criteria				
	Completeness	Effectiveness	Efficiency	Acceptability	Average
Alternative Plan 1	1	5	1	5	3.0
Alternative Plan 2	1	4	2	4	2.8
Alternative Plan 3	1	3	3	3	2.5
Alternative Plan 4	1	2	4	2	2.3
Alternative Plan 5	1	1	5	1	2.0

While Alternative Plan 5 is the plan which maximizes the net environmental benefits, it is even more important to recognize that the Marsh Lake is a dynamic system that is influenced by a combination of factors that result in its current degraded state. Improving conditions within the lake is contingent upon fully addressing each of the ecosystem restoration objectives outlined in Section 3.4. Acknowledging that implementation of any of the identified measures alone or in combination would provide benefits to the lake ecosystem, Alternative Plan 5 is the only plan which would include the full array of measures to address all of the problems and ecosystem restoration objectives identified by this Feasibility Study. Implementation of these alternative measures in combination would provide the greatest potential for successfully changing the Marsh Lake ecosystem state. While Alternative Plan 4 is slightly more efficient than Alternative Plan 5, the latter plan ultimately ranks higher in each of the remaining selection criteria.

6.5 Comparison of Effects of the Alternative Plans

Table 6.2 is a summary of relative impacts of the alternative plans. Each resource category has a relative impact range from -6 to +6 for long term and short term effects. The relative impacts for each plan are combined (added) to identify the relative cumulative effects for each alternative plan.

Negative values indicate negative impacts, 0 depicts no effect, and positive values represent benefits. The values indicate relative level of impact. N/A indicates not applicable. The values do not distinguish temporal or spatial scales, but are provided as a relative indicator of the magnitude of impacts. The sum of all the values provides a general overall comparison of the alternative plans. Alternative Plan 5 would have the most overall benefits in addition to the largest summation of long-term benefits.

Table 6-1. Relative effects of the alternative plans for ecosystem restoration at Marsh Lake.

Resource	Allternative Plan 0 No Action		Alternative Plan 1 Restore Pomme de Terre River to its former channel		Alternative Plan 2 Restore Pomme de Terre River to its former channel + Breach Dike at Abandoned Fish Pond		Alternative Plan 3 Alternative Plan 2 + Drawdown Structure + Louisburg Grade Road Culverts		Alternative Plan 4 Alternative Plan 3 + Modify Marsh Lake Dam to Attain Target Water Levels and Construct Fishway		Alternative Plan 5 Alternative Plan 4 + Construct Islands	
Time Duration S = Short L = Long	S	L	S	L	S	L	S	L	S	L	S	L
Vegetation	-5	-5	-4	-4	-3	-3	3	5	4	5	4	6
Wildlife	-5	-5	1	2	2	3	3	5	4	5	4	6
Aquatic Resources	-5	-5	2	3	2	4	3	5	4	5	4	6
T&E Species	0	0	-1	4	-1	4	-1	4	-1	4	-1	4
Wetlands	-5	-5	1	2	1	3	1	5	1	6	1	6
Floodplains	-2	-6	1	1	1	1	1	1	1	1	1	1
Aesthetics	-4	-4	1	3	1	3	1	4	1	5	1	6
Land Use	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cultural Resources	0	0	0	0	0	0	0	0	0	0	0	0
Recreation	0	0	3	3	3	3	3	4	4	5	4	6
Socioeconomics	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Transportation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HTRW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Air Quality	0	0	0	0	0	0	0	0	0	0	0	0
Noise	0	0	0	0	0	0	0	0	0	0	0	0
River Geomorphology	-2	-2	2	4	2	4	2	4	2	4	2	4
Surface Water	-3	-3	-2	-2	-2	-2	3	5	4	5	4	6
Stormwater	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Utilities/Public Service	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sum	-31	-35	4	16	6	20	19	42	24	45	24	51
Overall	-1.55	-1.75	0.2	0.8	0.3	1	0.95	2.1	1.2	2.25	1.2	2.55

6.6. Summary of Environmental Effects of the Alternative Plans

Impacts of the alternative plans are described below and in Appendix D, the Section 404(b)(1) Clean Water Act Evaluation.

Alternative Plan 0: No Action

The no action alternative plan would result in the without-project future conditions described in Section 2.10 above. This alternative plan would not meet the project objectives for ecosystem restoration.

Alternative Plan 1: Restore Pomme de Terre River to its Historic Channel

Restoring the Pomme de Terre River to its former channel would re-connect aquatic habitat between Lac qui Parle and the Pomme de Terre River. A number of native fish species like walleye, white suckers, white bass, and northern pike would be able to gain access to the relatively high quality habitat in the Pomme de Terre River for spawning and feeding. This increased access to higher quality habitat would have positive effects on the size and fitness of the fish populations and resiliency of the fish community.

Although mussels in the lower reach of the Pomme de Terre River between the cut-off embankment and Marsh Lake would be killed by construction and lack of river flow, native mussels are expected to colonize the newly restored channel.

Fish in Marsh Lake would be subject to more severe low dissolved oxygen conditions during winter with the Pomme de Terre River diverted back into its former channel. This would reduce abundance of carp which contribute to turbidity and sediment resuspension. Northern pike are tolerant of low dissolved oxygen conditions during winter and the project would create conditions that generally favor native species. Sediment loads originating from the Pomme de Terre River would be eliminated within Marsh Lake as a result of the restoration of the Pomme de Terre to its historic channel. This reduction in sediment load will have a beneficial impact on the turbidity and overall water quality within the lake.

Restoring the Pomme de Terre River to its former channel would directly disturb the soil in the borrow area where material to construct the cut-off embankments would be removed. The area is currently an upland agricultural field. The borrow area would be covered with topsoil and planted with native vegetation. The borrow area would become more prone to flooding and would support native wet meadow vegetation.

Placing fill for the channel cut-off embankment to divert the Pomme de Terre River into its original channel would directly cover approximately 0.3 acres of the diverted portion of the river channel. All macroinvertebrates in the filled area would be killed. The area would be converted from aquatic habitat to terrestrial habitat.

No excavation of the historic channel will be required in order to reroute the Pomme de Terre River. Once rerouted into its former channel, the lower Pomme de Terre River would scour out approximately 1425 cubic yards of fine silty sediment that has accumulated in its former channel through natural processes. Some of that material would be deposited over-bank in the river floodplain; the rest of the material would be transported into Lac qui Parle.

Pomme de Terre River flow would be diverted into the historic river channel flowing into the Minnesota River downstream of the existing Marsh Lake Dam. The reach of the existing channel between the cut-off embankment and Marsh Lake would cease to flow. Most of the macroinvertebrates and mussels in that channel would die due to lack of flow and low dissolved oxygen. In addition, sediment loads previously entering Marsh Lake would flow into Lac qui Parle. Suspended sediment loading to Lac qui Parle would not change given the proximity of the existing Pomme de Terre outlet to the Marsh Lake Dam spillway. During higher levels of river discharge, sediment from the Pomme de Terre River would flow overbank and be deposited in the floodplain near the confluence with the Minnesota River.

Alternative Plan 2: Restore Pomme de Terre River to its Historic Channel + Breach Dike at Abandoned Fish Pond

This alternative plan would have the same impacts as Alternative Plan 1 described above. The additional measure of breaching the abandoned fish pond dike would not have adverse environmental effects and would provide fish in Lac qui Parle access to the fish pond area. The fish pond area would provide habitat for shorebirds and fish-eating birds.

Alternative Plan 3: Alternative Plan 2 + Drawdown Structure + Gated Culverts at Louisburg Grade Road

Alternative Plan 3 would have the effects described for Alternative Plan 2 above. Constructing the water control structure and replacing the culverts at Louisburg Grade Road would include temporary and localized increased suspended solids during construction. Growing season drawdowns of Marsh Lake would be done to restore emergent aquatic vegetation and winter drawdowns would be done to reduce carp abundance. Drawdowns would not be done every year, but as needed to restore vegetation and reduce carp abundance. Winter drawdowns should reduce carp abundance, grazing by carp on aquatic vegetation and macroinvertebrates, and sediment resuspension by carp. Drawdowns of Marsh Lake water level would kill benthic macroinvertebrates and some species of submersed aquatic plants in the dewatered areas. Sago pondweed, the target species of forage for migratory waterfowl, should persist through winter conditions noted above, thereby increasing in abundance within the lake.

The increased extent and abundance of emergent aquatic plants would provide food and habitat for many wetland species and would reduce wind-driven wave action and sediment resuspension.

Drawdowns of Marsh Lake water level would not go below elevation 936.0 to avoid dewatering the area between the colonial nesting bird islands and the shoreline to maintain protection of the islands from predators like foxes, coyotes, raccoons and skunks.

Installing water control structures in the Louisburg Grade Road culverts would allow northern pike to gain access to upper Marsh Lake and successfully spawn in years when Marsh Lake is drawn down.

Alternative Plan 4: Alternative Plan 3 + Modify Marsh Lake Dam to Attain Target Water Levels and Construct Fishway

This alternative plan would have the impacts as described for Alternative Plan 3. Construction of the fishway weir structure would result in localized and temporary increases in suspended solids. The fishway weir would provide passive water control for Marsh Lake water levels, restoring a more natural annual stage hydrograph. The fishway weir would provide target late summer and winter water levels that are lower than currently occur. This would improve growth of aquatic vegetation in Marsh Lake. The fishway would provide habitat connectivity for fish to move between Lac qui Parle and Marsh Lake, increasing the available habitat. Construction of a fishway weir would remove the dangerous ogee-crest spillway, improving safety at the dam for visitors.

Alternative Plan 5: Alternative Plan 4 + Construct Islands in Marsh Lake

This alternative plan would have impacts as described for Alternative Plan 4. In addition, construction of islands in Marsh Lake would result in localized and temporary increases in suspended solids. Benthic macroinvertebrates in the footprint of the islands would be killed. The islands would effectively reduce wind fetch, wave action and sediment resuspension in a large area in Marsh Lake, providing conditions more conducive to growth of submersed aquatic plants. Increased growth of submersed aquatic plants would provide food for waterfowl. The submersed plants would further reduce wind fetch and sediment resuspension resulting in clearer water for native fish. The rock islands would provide hard substrate for filter-feeding macroinvertebrates like caddisflies that are food for fish. The rock islands would provide sheltered resting areas for migrating waterfowl.

6.7 Effects on Environmental Resources

Table 6-2 is an environmental impact assessment matrix which provides a cursory overview contrasting the social, natural resource, economic, and cultural effects between the Action Alternative Plans (Alternative Plans 1-5) and the No-Action Alternative. All Action Alternative Plans are included categorically within the matrix and are assumed to bear effects increasing incrementally between plans.

Table 6-2. Environmental impact assessment matrix for the Marsh Lake project.

IMPACT ASSESSMENT MATRIX

NAME OF PARAMETER	NO ACTION							ALL ACTION ALTERNATIVE PLANS						
	MAGNITUDE OF PROBABLE IMPACT							MAGNITUDE OF PROBABLE IMPACT						
	<--- INCREASING BENEFICIAL				INCREASING ADVERSE --->			<--- INCREASING BENEFICIAL				INCREASING ADVERSE --->		
	SIGNIFICANT	SUBSTANTIAL	MINOR	NO APPRECIABLE EFFECT	MINOR	SUBSTANTIAL	SIGNIFICANT	SIGNIFICANT	SUBSTANTIAL	MINOR	NO APPRECIABLE EFFECT	MINOR	SUBSTANTIAL	SIGNIFICANT
A. SOCIAL EFFECTS														
1. Noise Levels				X							X			
2. Aesthetic Values					X					X				
3. Recreational Opportunities						X			X					
4. Transportation				X							X			
5. Public Health and Safety					X					X				
6. Community Cohesion (Sense of Unity)				X							X			
7. Community Growth & Development				X							X			
8. Business and Home Relocations				X							X			
9. Existing/Potential Land Use				X							X			
10. Controversy				X							X			
B. ECONOMIC EFFECTS														
1. Property Values				X							X			
2. Tax Revenues				X							X			
3. Public Facilities and Services				X						X				
4. Regional Growth				X							X			
5. Employment				X							X			
6. Business Activity				X							X			
7. Farmland/Food Supply				X							X			
8. Commercial Navigation				X							X			
9. Flooding Effects				X							X			
10. Energy Needs and Resources				X							X			
C. NATURAL RESOURCE EFFECTS														
1. Air Quality				X								X		
2. Terrestrial Habitat				X							X			
3. Wetlands						X			X					
4. Aquatic Habitat						X			X					
5. Habitat Diversity and Interspersion						X			X					
6. Biological Productivity						X			X					
7. Surface Water Quality						X			X					
8. Water Supply				X							X			
9. Groundwater				X							X			
10. Soils				X							X			
11. Threatened or Endangered Species				X								X		
D. CULTURAL EFFECTS														
1. Historic Architectural Values				X							X			
2. Pre-Hist & Historic Archeological Values				X							X			

6.7.1 Aesthetic Values

With the no action alternative, degradation of the existing natural resources at the site currently does and will continue to have a minor adverse impact on aesthetics for visitors to the site. Implementation of any of the Action Alternative Plans will increase the resource values and subsequent aesthetics of the site through improvements to area natural resources, namely Marsh Lake and the Pomme de Terre River. As the Action Alternative Plans increase in scale, the beneficial impact to resources increases. Winter fish kills will likely result in a temporary impact to aesthetics at the site, however, the rural nature of the management area will not present any lasting impact to area residents in the form of odor or other aesthetics.

6.7.2 Recreational Opportunities

With the no action alternative, recreational users of the site will experience a lower quality recreational experience in the future due to aging recreation infrastructure and degraded ecosystem values. Implementation of the stand-alone Recreation Plan will increase the resource value and recreational experience at the site through improvements to area natural resources and recreational infrastructure. As the Action Alternative Plans increase in scale, the beneficial impact to resources increases. The recreation plan proposed for the site will substantially improve opportunities for wildlife viewing, fishing and hunting at the site. Recreation will be temporarily impacted during construction, particularly around the dam. An existing canoe landing on the Pomme de Terre River will be relocated to the historic channel, but full recreational use of the site will be restored following project completion.

6.7.3 Transportation

None of the Alternative Plans impact any major roads or waterways. During construction, the hauling of materials and equipment may cause brief and temporary detours.

6.7.4 Public Health and Safety

As with all water control structures, there is an inherent risk of drowning, particularly in areas where recreation and water control structures coexist, as in the case of Marsh Lake Dam. As noted previously in Section 3, a drowning death did occur at the dam in 1991. While such incidents are infrequent, the dam does pose a minor threat to the safety of visitors to the site. Any of the Action Alternative Plans involving the modification of the Marsh Lake Dam (Alternative Plans 3-5) will improve the safety at the site through alteration to the hydraulic roller on the downstream portion of the dam, resulting from construction of the fishway. Reducing the hydraulic roller will have a minor increase to public safety at the site, but risk of accidental drowning will always remain.

6.7.5 Community Growth and Development

The recommended plan will likely benefit local income and employment due to construction activities.

6.7.6 Business and Home Relocations

None of the Alternative Plans are expected to have impact to housing, as the project area is not near any development and occurs entirely on public lands. During construction, temporary lodging may be needed in nearby communities for non-local workers.

6.7.7 Public Facilities and Services

As noted above in Section 6.7.2, with the no action alternative recreational users will experience a decline in the quality of public facilities over time due to aging infrastructure and degraded ecosystem values. Improving recreation with the Action Alternative Plans, as noted above, improves public facilities and the user experience offered by the Minnesota Department of Natural Resources as well as the U.S. Army Corps of Engineers.

6.7.8 Air Quality

Any construction activity at the site will result in a minor impact to local air quality. The effects will be temporary during the duration of construction.

6.7.9 Wetland Resources

Effects on aquatic and wetland resources are described in detail in Appendix D Section 404(b)(1) Clean Water Act Evaluation. Riparian wetlands along Marsh Lake, Lac qui Parle and the Pomme de Terre River will benefit from the ecosystem variability provided by natural resource improvements of the Action Alternative Plans recommended. Greater variation in water levels will allow for seasonal variability, consolidation of bottom sediments, reduced light attenuation from suspended sediment, increased abundance of submersed aquatic vegetation and increased abundance of emergent aquatic vegetation. Implementation of any of the Action Alternative plans would increase habitat quality for many wetland species by increasing the area of vegetated wetlands within the designated project area.

6.7.10 Aquatic Habitat

Aquatic habitat is substantially impact by the current conditions in Marsh Lake resulting from the multiple stressors of sediment loading, sediment resuspension, and lack of ecosystem connectivity and the dominance of invasive species. Implementation of any of the Action Alternative Plans will increase the aquatic habitat values of the site through addressing and alleviating stressors within Marsh Lake and the Pomme de Terre River. As the Action Alternative Plans increase in scale, the beneficial impact to resources increases (as summarized in Section 6.6).

6.7.11 Habitat Diversity and Interspersion

Similar to aquatic habitat noted above, habitat diversity and interspersion is substantially impact by the current conditions in Marsh Lake resulting from the multiple stressors of sediment loading, sediment resuspension, lack of ecosystem connectivity and the dominance of invasive species. Implementation of any of the Action Alternative Plans will increase both submersed and aquatic vegetation throughout Marsh Lake through addressing and alleviating stressors to the ecosystem. As the Action Alternative Plans increase in scale, the beneficial impact to resources increases (as summarized in Section 6.6).

6.7.12 Biological Productivity

Similar to aquatic habitat noted above, habitat diversity and interspersion is substantially impact by the current conditions in Marsh Lake resulting from the multiple stressors of sediment loading, sediment resuspension, lack of ecosystem connectivity and the dominance of invasive species. Implementation of any of the Action Alternative Plans will improve habitat quantity and quality and subsequently improve the biological productivity of waterfowl, fish and other organisms that depend on aquatic vegetation. As the Action Alternative Plans increase in scale, the beneficial impact to resources increases (as summarized in Section 6.6). Winter fish-kills occur periodically at the site in its existing condition and will continue to occur in the future with Action Alternative Plan implementation. Biological productivity of fish in Marsh Lake will be temporarily impacted during winters following drawdowns, however, improved ecosystem connectivity will allow for spring migration of fish from both the Minnesota River and Louisburg Grade Road area upstream as well as Lac qui Parle from the downstream end, ultimately improving the structure of the fishery from the current carp-dominated system. There is currently no plan to physically remove dead fish from the water following a winter fish-kill. Fish-kills under the ice are not assumed to impact biological oxygen demand as the majority of decomposition will occur simultaneously with spring flows and snow melt where dissolved oxygen levels within the lake will increase.

6.7.13 Surface Water Quality

Similar to aquatic habitat noted above, surface water quality is substantially impacted by the current conditions in Marsh Lake resulting from the multiple stressors of sediment loading, sediment resuspension, lack of ecosystem connectivity and the dominance of invasive species. Implementation of any of the Action Alternative Plans will improve long-term surface water quality throughout Marsh Lake by addressing and alleviating stressors to the ecosystem. As the Action Alternative Plans increase in scale, the beneficial impact to resources increases (as summarized in Section 6.6).

Rerouting the Pomme de Terre River into its historic channel will result in a temporary increase in sediment loading to Lac qui Parle. It is assumed that the historic channel will scour latent sediment over the course of the first season. Construction activities such as the diversion dikes of the Pomme de Terre River, the construction of a drawdown structure, the breaching of the abandoned fish pond dike, and the replacement of culverts at Louisburg Grade Road will result in exposed soil and bare slopes near surface waters. Erosion potential will be mitigated through the implementation and use of best management practices such as silt fence, erosion control blanket and temporary seeding during construction to minimize the negative impact on surface waters. Through use of best management practices, no adverse effects are anticipated from soil erosion near project features during construction.

6.7.14 Endangered Species

No Federally-listed threatened or endangered species occur in the Marsh Lake project area. Bald eagles nest and feed in the area. They are no longer listed as a Federal endangered species, but they are still protected by the Bald and Golden Eagle Protection Act. None of the alternative plans would affect any Federally-listed threatened or endangered species.

The bald eagle is a state-listed threatened species. The Dakota skipper is a rare prairie butterfly that occurs in the project area that is a candidate for state listing. The Pomme de Terre River has regionally significant populations of elktoe mussels (*Alasmidonta marginata* – state-listed as threatened) and black sandshell (*Ligumia recta* – state-listed as special concern). Mussels living near the existing outlet of the Pomme de Terre River would be adversely affected by the rerouting of the river. Re-routing the

Pomme de Terre River would include monitoring of mussels in the restored channel and the mussel population is expected to fully recover following project completion.

6.7.15 Cultural Resources

The area of potential effects for the Marsh Lake ecosystem restoration project consists of Marsh Lake dam and embankment, the pre-dam/restored Pomme de Terre River channel above and below the dam embankment, the cutoff dike locations above the dam embankment, the culverts along Louisburg Grade Road, the locations in Marsh Lake where three breakwater islands would be constructed, the abandoned fish rearing pond below the dam, and a proposed borrow area for material to construct the cutoff dikes for re-routing the Pomme de Terre River. The lakeshore and island shorelines at Marsh Lake is part of the area of potential effects for future growing season drawdowns, which can only occur after installation of the proposed water management structure at Marsh Lake Dam's existing emergency spillway and installation of stoplog structures at the culverts through Louisburg Grade Road.

Marsh Lake Dam (SW-APT-003) is currently the only historic property listed on or determined eligible to the National Register of Historic Places which will be directly affected by any modifications to the dam. When Marsh Lake Dam was built, the Pomme de Terre River was diverted to enter the reservoir above its dam embankment. Restoring the river to its pre-dam channel would involve cutting a notch through the Marsh Lake Dam embankment at the old river channel and constructing a bridge over the channel notch to allow continued access to the dam. The restored channel would not be dredged or otherwise modified so no disposal area would be needed. The flow of the Pomme de Terre River would be allowed to scour accumulated sediment and debris from the old channel. The diverted river channel would be abandoned. Earthen cutoff dikes or plugs would be constructed across two low areas and the diverted river channel above the dam embankment to prevent Marsh Lake from spilling into the restored river channel at times of high water. No archeological sites were located along the pre-dam/restored Pomme de Terre River channel or the cutoff dike locations during the 2008 Phase I cultural resources survey of these areas (Magner 2008). Any potential borrow area to be used for cutoff dike construction material will have a cultural resources survey conducted and coordination under Section 106 of the National Historic Preservation Act completed with the Minnesota SHPO prior to its use for project construction. Any proposed borrow area containing archeological site(s) will not be used.

The existing fixed-crest spillway of Marsh Lake Dam would be modified into a rock nature-like fishway which will allow for fish passage between Marsh Lake and Lac qui Parle Lake downstream. A new water management structure with 12 stoplog bays would be constructed at the existing emergency spillway to allow future manipulation of Marsh Lake's water levels. Future growing season drawdowns of Marsh Lake would be used as needed to restore aquatic vegetation beneficial to waterfowl. A pedestrian and bicycle bridge would be constructed over the fishway and the new water management structure to allow passage over the dam as part of the Minnesota State Trail. These proposed changes will alter the overall appearance and design of Marsh Lake Dam and embankment, but will not change the original purpose of the dam or the overall Lac qui Parle Flood Control Project. A Memorandum of Agreement to cover mitigation of adverse effects of the ecosystem restoration project to Marsh Lake Dam will be negotiated with the Minnesota State Historic Preservation Officer (SHPO) and Advisory Council on Historic Preservation, with mitigation to be completed prior to beginning construction on the proposed modifications to the dam and its embankment.

Archeological sites 21LP33 and 21BS67 in lower Marsh Lake (between Marsh Lake Dam and Louisburg Grade Road) and archeological sites 21LP36, 21BS47 and the Area J Granite Quarry site in upper Marsh Lake (between Louisburg Grade Road and Highway 75) may be eligible to the National Register of Historic Places. None of these five sites will be directly affected by construction of the proposed ecosystem restoration features at Marsh Lake. Construction of the breakwater islands in Marsh Lake are intended to reduce wave-caused sediment resuspension and should reduce erosion of the shoreline and islands in the lake and thus should protect island site 21BS67 from further erosion. In addition, natural armoring of the lakeshore and island shorelines against future erosion has been taking place as past erosion has exposed and deposited rocks and cobbles from the glacial soils in these areas. Future water level drawdowns of lower Marsh Lake would expose land presently inundated along the current lakeshore and island shorelines. Such a drawdown would not directly affect site 21LP33, which is located on a ridgetop back from the current shoreline. Site 21BS67 should not be adversely affected as a drawdown of lower Marsh Lake should not induce further erosion at that island site's location. Future water level drawdowns on upper Marsh Lake would not affect sites 21LP36, 21BS47, or the Area J Granite Quarry due to their locations on raised areas within or adjacent to the marshes covering most of the bottomlands between Louisburg Grade Road and Highway 75.

The archeological survey identified additional sites that were determined not eligible to the National Register (site 21BS35 in lower Marsh Lake and sites 21BS41, 21BS42, 21BS43, 21BS44, 21BS45, and 21BS46 in upper Marsh Lake) (Minnesota SHPO letter dated January 16, 2002). No further cultural resources investigations need be conducted at their locations.

Coordination between the Corps and SHPO resulted in the determination that mitigation is required for impacts resulting from modifications to the Marsh Lake Dam. As a part of this agreement, the historical conditions of the Marsh Lake Dam will be properly documented prior to any construction or alternation at the site.

6.7.16 Environmental Justice

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," provides that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." The Executive Order makes clear that its provisions apply fully to programs involving Native Americans.

The proposed project will not have a disproportionately high adverse effect on minority or low income populations and is in compliance with EO 12898. The project is located in a rural area with few residents nearby. Native American communities in the region do not use Marsh Lake or Lac qui Parle for subsistence hunting, gathering or fishing. The project would generally have beneficial social and economic effects and would generally affect all persons equally.

6.7.17 Cumulative Effects

Cumulative effects are the impacts on the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes the actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

The cumulative effects of past actions on natural resources in the Marsh Lake project area have been large. Land cover has been altered from native prairie to intensive agriculture. Streams and rivers in the Upper Minnesota River Basin have been impounded, channelized, and regulated for flood damage reduction. The economy of the area has changed markedly in the last two centuries.

For this feasibility study and environmental assessment, the effects of the Marsh Lake ecosystem restoration project are addressed for cumulative impacts. The future without-project condition is described in Section 2 above. Some reasonably foreseeable actions and related ecosystem conditions that are either being planned or considered by other agencies or groups in the project area include the following:

- Continued operation and maintenance of the Lac qui Parle Flood Control Project
- Continued use and management of the Lac qui Parle Wildlife Management Area as a wildlife and hunting area
- Continued agricultural use of much of the Upper Minnesota River Basin.
- Improving water quality conditions in the Minnesota River through watershed and water quality management efforts in the basin to reduce nutrient and sediment loading
- Continued management of the popular walleye fishery in Lac qui Parle by the DNR
- Continued and increasing recreation activity

Impacts of the alternative plans are summarized in this report under Section 6.6 for adverse and beneficial effects. The intent of the Marsh Lake project is to maximize the extent and impact of beneficial effects on Marsh Lake, Lac qui Parle and the Pomme de Terre River to achieve the project objectives and the goal of returning the Marsh Lake area ecosystem to a less degraded and more natural and functional condition. Individually, each management measure would have a beneficial effect to counteract the stressors acting upon the Marsh Lake area ecosystem.

Anthropogenic influences within the watershed will not change as a result of project implementation. Sediment and nutrient loading will continue from both the Minnesota and the Pomme de Terre Rivers. Future efforts at watershed and water quality management are expected to reduce sediment and nutrient loading to the Minnesota River. Implementation of the project will minimize the adverse impacts of sediment and nutrient loading on the resources within the project area leading towards achievement of the project objectives.

The habitat and land cover changes that would occur are described above. The Pomme de Terre River channel would be restored to its former channel and should remain in that geometry for the foreseeable future. The Marsh Lake Dam would be modified with a fixed crest fishway and a controllable outlet structure. Approximately 41,045 cubic yards of rock would be removed from nearby field stockpiles and placed in Marsh Lake to construct islands. Nonrenewable petroleum fuel would be used to power trucks, excavators, towboats, and other equipment used in the construction.

7. RECOMMENDED PLAN

The alternative plan that reasonably maximizes the benefits in relation to cost and meets the overall planning objectives is Alternative Plan 4. Alternative Plan 4 is recommended as the National Ecosystem Restoration Plan (NER Plan), described below in Section 7.1. On a relative scale, the incremental increase between Alternative Plans 3 to 4 is high; however, when viewed relative to the costs of similar ecosystem restoration projects, the average costs per habitat unit are relatively low. The $56.41 per AAHU created by the project is extremely efficient in achieving the stated ecosystem objectives (see Figure 5-15) and therefore deemed reasonable in cost. While Alternative 5 maximized ecosystem outputs, the last increment (per Section 6) of $2072.33 was not found to be cost efficient for inclusion in the NER Plan. Future monitoring detailed in Appendix R will provide information on the need for the last increment through future analysis. The NER Plan has strong support from the non-Federal sponsor and is consistent with regional and State planning for the area.

7.1 National Ecosystem Restoration Plan Description

Alternative Plan 4 is a combination of five of the stand alone restoration measures which include:

- Restore the Pomme de Terre River to its historic channel - The Pomme de Terre River will be rerouted into its former channel in a meander loop upstream of Marsh Lake Dam and into the longer former channel downstream of the Marsh Lake Dam by constructing three earthen cut-off dikes (Figure 4-1). The total length of river channel that would be restored is approximately 11,500 feet. With an average 80-ft wide channel, approximately 21 acres of river channel would be restored. This action will reduce sediment loading, restore floodplain processes to the Pomme de Terre River delta downstream of the Marsh Lake Dam, a 293-acre area as well as restore connectivity between Lac qui Parle and the Pomme de Terre River.
- Breach dike at abandoned fish pond - Breaching the dike in the abandoned fish pond will allow water levels within it to be the same as in the upper end of Lac qui Parle, and would allow fish access to the area. The shallow abandoned fish pond area will also provide shorebird habitat during times when Lac qui Parle water level is low.
- Construct drawdown water control structure - A water control structure will be built in the existing overflow spillway area to provide controlled discharge capacity to enable a drawdown. Growing season drawdowns are typically conducted following spring high water into September when plants go senescent. Growing season drawdowns can be done in two consecutive growing seasons to allow plants germinated in the first year to grow to full size before flooding to normal water levels. Once established, perennial aquatic plants can persist for years, providing valuable food and habitat for fish and wildlife. The drawdown structure would be 113.5-feet wide with 10 bays. The water control structure would have a 16-ft wide walkway across the top that could serve a secondary purpose as part of a trail across the dam in the future. Operation of the drawdown structure will be conducted consistent with the Monitoring and Adaptive Management Plan included in this report.
- Construct Louisburg Grade Road gated culverts - Water levels in the upper part of Marsh Lake will be managed separately from the main body of the lake,

particularly in drawdown conditions. For example, high water levels can be maintained for a time in early spring to provide flooded marsh habitat upstream of the Louisburg Grade Road for spawning northern pike and to improve survival of young-of-year fish. The stop logs would subsequently be removed to allow the fish to return to Marsh Lake. Implementation of this measure is designed to enhance both the fishery throughout Marsh Lake and promote native fish dominance.

- Modify the Marsh Lake Dam, construct fishway - Marsh Lake Dam will be modified with a fishway structure to provide a passive weir that would increase water level variability on Marsh Lake, attain the target water level regime and to allow year-round fish passage (Figure 4-4). The fishway will be constructed in the existing fixed crest spillway in Marsh Lake Dam. Nature-like fishways are effective in re-establishing fish migration routes past dams and other hydraulic obstacles. Nature-like fishways simulate natural river channels and the hydraulic conditions that fish have evolved to swim through. Nature-like fishways can be simple rock ramps that look like natural rapids or bypass channels with riffles and pools. Many nature-like fishways have been constructed in Minnesota and have been very effective in restoring migratory fishes to stream networks. The fishway design contains a series of arched rock riffles that concentrate flow toward the middle of the fishway. Shallow areas on the sides would have slower current velocities and would allow upstream passage by smaller and weaker-swimming fish. The riffles would be made of boulders imbedded into smaller rock, with pools of deeper water between the riffles. Water would flow between the boulders in the riffles at velocities that fish could still swim through.

With cost figures rounded to the nearest thousand, the estimated first project costs of the ecosystem restoration plan are $9,463,000 (average annual cost of $474,000 with OMRR&R) and would result in the creation of approximately 8400 AAHU over 50 years. A plan view of the recommended plan is included below in Figure 7-1:

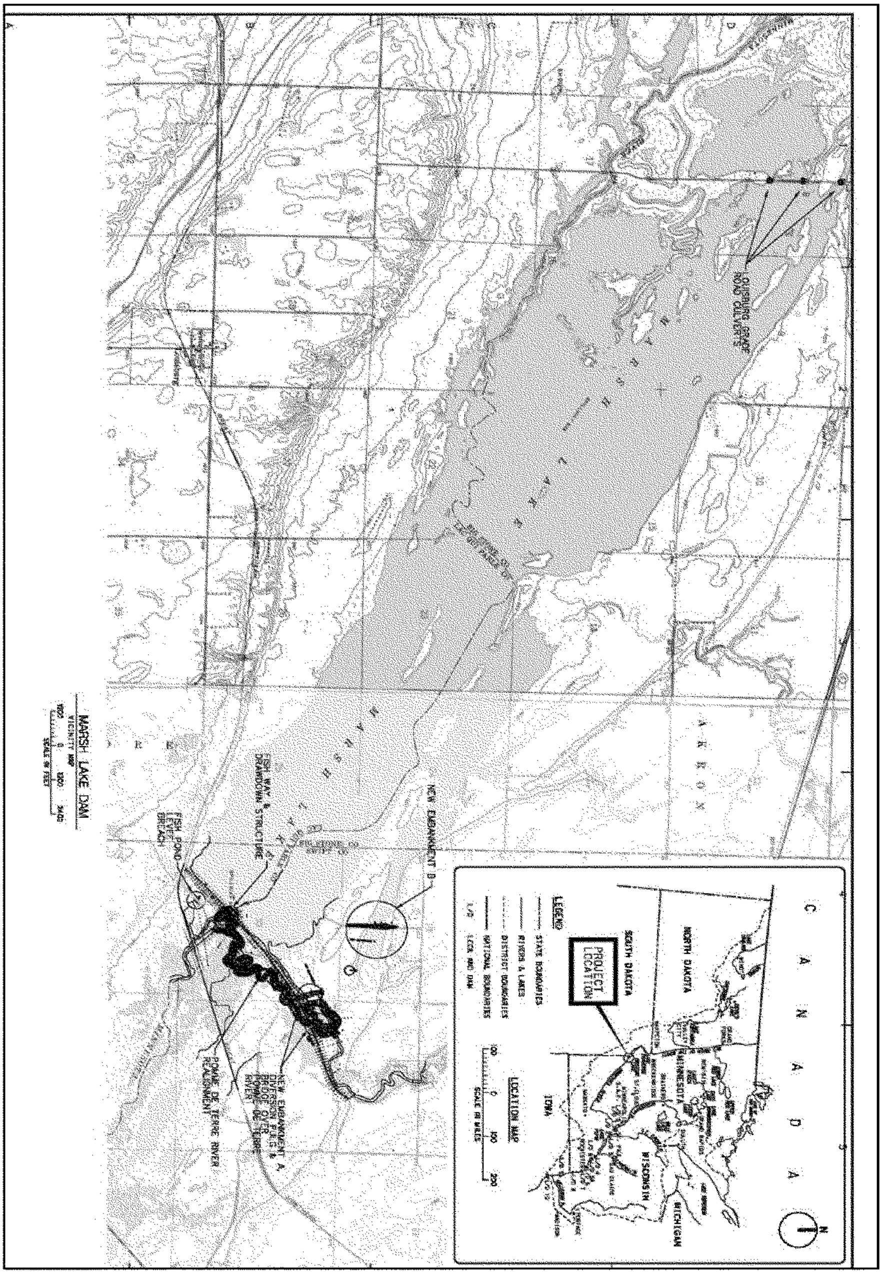


Figure 7-1, Plan view of the recommended plan project features

Problems and stressors addressed by the recommended plan include:

Marsh Lake Ecosystem State:

- Sediment Loading – **Restoring the Pomme de Terre** to the historic channel will serve to reduce sediment loading into Marsh Lake. Since turbidity is a limiting factor in the light attenuation and primary production in the aquatic community, sediment loading must be addressed in order to provide forage for migratory waterfowl that are limited by the availability of food within the lake. Rerouting the river to its historic channel will eliminate the Pomme de Terre as a sediment source to Marsh Lake and thereby decrease the turbidity within the lake, specifically near its current outlet.
- Sediment Resuspension – **Modification of the Marsh Lake Dam** to attain target water levels will induce seasonally lower levels in the lake and allow for consolidation of bottom sediments as well as light penetration to both exposed sediments for emergent plants and deeper depths for aquatic vegetation. **Construction of a water control drawdown structure** will allow lake managers to artificially mimic natural riverine drought conditions by periodically conducting drawdowns to lower water levels below the current outlet elevation which will assist in consolidating sediments for up to 90% of the lake area, germinate seeds within the lake sediments and allow for the penetration of light to the lake bottom sediments to enable plant growth. In combination, each of the identified measures for addressing sediment resuspension complements one another through synergistic relationships to ensure the establishment of healthy habitats and robust plant communities. The presence of aquatic vegetation and consolidated bottom sediments will ultimately reduce the frequency of high turbidity resulting from sediment resuspension and subsequently increase emergent and aquatic plant growth which is critical to support both fish and waterfowl communities.
- Lake Level Variability - **Modification of the Marsh Lake Dam** to attain target water levels will create greater variability in lake levels, allowing the lake to mimic more natural historical riverine conditions. As a result, lake levels will fluctuate with climatic conditions, creating greater ecosystem flux thereby increasing the functionality of floodplain and riparian areas.

Construction of a water control drawdown structure will allow lake managers to mimic natural riverine drought conditions by periodically conducting drawdowns to consolidate sediments for up to manage sediment resuspension (noted above) and enable plant growth. Introducing greater variability will benefit both floral aquatic and emergent communities within the lake and the fauna that depends on it, particularly waterfowl.

- Ecosystem Connectivity – **Restoring the Pomme de Terre River** to its former channel would provide walleye, white suckers, white bass and other migratory fish species in Lac qui Parle access to high quality spawning and nursery habitat in the Pomme de Terre River. Improved reproduction success and growth of juvenile fish in the Pomme de Terre River would increase the abundance of naturally-reproduced walleye in Lac qui Parle and would increase the diversity of the fish community. **Installation of gated culverts at Louisburg Grade Road** is a measure dependent upon **construction of a water control drawdown structure**. When growing season drawdowns are artificially conducted through the drawdown structure, the culverts at Louisburg Grade Road would be closed, impounding approximately 1100 acres of water upstream. This impounded area would serve as winter refuge for fish and preserve critical spring spawning habitat for northern pike. In the spring following drawdowns, the gates would be reopened. Native fish released from upstream of Louisburg Grade Road in addition to those migrating upstream from Lac qui Parle will benefit from reduced competition in the lake due to the lack of over-wintering populations of invasive common carp (see below). **Breaching the abandoned fish pond** adjacent to the Marsh Lake Dam will also provide additional connectivity to a currently isolated impoundment within the river previously managed by the DNR as a fish rearing pond. The fish pond area serves as valuable habitat for birds such as the great blue heron who fish this area frequently. Breaching the dike for the fish pond will allow fish access to the pond which will subsequently increase the food availability for herons and enhance the habitat value.

Low-Diversity Fish Community:

- <u>Invasive Species</u> - **Construction of a water control drawdown structure** to induce artificial drawdowns will serve to eliminate winter refuge for common carp within the lake. As an invasive species, carp are notoriously voracious foragers on aquatic plants. Elimination of carp in the wintertime will serve to both restore plant communities and augment the lake with native fish species through displacement in the spring following drawdowns. **Modification of the Marsh Lake Dam** to a lower elevation in conjunction with the construction of a fishway will enable passage of native fish between Lac qui Parle and Marsh Lake annually during spawning season, but particularly in the spring after artificial drawdowns. This effort is intended to displace invasive common carp with native fish throughout Marsh Lake. **Restoring the Pomme de Terre** to its historic channel will eliminate both a winter oxygen source within Marsh Lake as well as the physical connection between over-wintering carp communities in Marsh Lake with spawning habitat upstream on the Pomme de Terre. While common carp would still have availability and access to the Pomme de Terre from the restored outlet at Lac qui Parle, abundance and frequency of carp within Marsh Lake itself will decrease due to the cumulative effects of the combined measures noted above.
- <u>Ecosystem Connectivity</u> - **Restoring the Pomme de Terre** to the historic channel will provide access to walleye from Lac qui Parle to spawn. The walleye population within Lac qui Parle is stocked but healthy and available spawning habitat has been determined to be the limiting factor in the abundance of walleye within Lac qui Parle and Marsh Lake. **Modification of the Marsh Lake Dam** to a lower elevation in conjunction with the construction of a fishway will enable passage of native fish between Lac qui Parle and Marsh Lake. This will allow the northern pike community within Lac qui Parle to gain access to the spawning areas upstream of the Louisburg Grade Road. The subsequent effect will be healthier communities of pike within both Marsh Lake and Lac qui Parle. **Installation of gated culverts at Louisburg Grade Road** will ensure that lake elevations within the critical pike spawning area upstream of the Louisburg Grade Road are maintained as Marsh Lake water levels are

subjected to increased variability from the implementation of measures noted above.

Degraded Pomme de Terre Ecosystem State:

- Sediment Deposition - **Restoring the Pomme de Terre** to the historic channel will eliminate sediment deposition within Marsh Lake and restore a more natural, free flowing, meandering channel to the Pomme de Terre River. In its current state, the outlet of the Pomme de Terre into Marsh Lake occurs at a low gradient which is prone to deposition of sediment conveyed by the river at the outlet. This sediment becomes actively available for resuspension from physical force (wave, wind) and contributes to turbidity issues within Marsh Lake. Restoration of the historic channel will increase channel slope, channel length, the overall area of habitat availability, and will alter the composition of the river bottom through natural geomorphic processes from a system dominated by deposition of small grain size particles to a rocky, cobble substrate. The change in geomorphic form and habitat structure will provide critical spawning areas for walleye and other fish from Lac qui Parle.
- Ecosystem Connectivity - **Restoring the Pomme de Terre** to the historic channel will open new areas upstream of Lac qui Parle to the community of walleye who are limited by spawning habitat availability. As noted above, habitat suitability and access for walleye within Pomme de Terre are constrained by the presence of the Marsh Lake Dam and the current geomorphic condition. Rerouting the Pomme de Terre will have a substantial beneficial effect for walleye as well as other fish within Lac qui Parle.

7.2 Recreation-Related Project Features

The U.S. Army Corps of Engineers policy for ecosystem restoration projects recognizes that the lands used for project construction can also provide a low cost opportunity to provide recreation facilities. Recreation at ecosystem restoration projects should:

- Be compatible with ecosystem restoration and enhance the visitation experience.
- Build upon the ecosystem restoration objective rather than distract from it.
- Take advantage of the education and recreation potential of the ecosystem project.

Consistent with these purposes, a stand-alone Recreation Plan was developed and is detailed below. This Recreation Plan has been prepared through meetings among the US Army Corps of Engineers, the US Fish and Wildlife Service, and the Minnesota DNR. The team used Value Engineering techniques to brainstorm existing and potential recreational features then weigh the advantages, disadvantages and cost of each feature to develop an overall concept to include:

1. **Pedestrian Bridge across Marsh Lake Spillway** for improved safety, to provide angler access to both sides of the river, and as a future state bike trail connection.

2. **U.S. Army Corps of Engineers Day Use Facility at Marsh Lake Dam Improvements** to include a Pomme de Terre Canoe Access Point, a portage area, picnic tables, and shoreline fishing platforms.

3. **Shoreline Access Upgrades** to include shoreline fishing and interpretive signage.

All of the recreational features took into consideration the objectives of the Ecosystem Restoration project and also the Minnesota State Comprehensive Outdoor Recreation Plan's (SCORP) goal of increasing participation in outdoor recreation by Minnesotans and visitors.

Providing future recreational opportunities is an important goal of this region, as recreation would provide tourism dollars to the local economy and helps maintain a higher quality of life by providing opportunities for recreational experiences.

The major parts of the Recreation Plan are to:

(1) Increase connectivity to existing and future trail systems in the area.
(2) Upgrade existing facilities and create new facilities where needed.
(3) Provide interpretation and education at Marsh Lake.

Implementation of recreation features will help the State of Minnesota reach its goals of providing economic and recreational opportunities to its citizens.

Future conditions without recreational features will result in lost opportunities to:

- Provide connectivity of at least four different trail systems –National Scenic Byway, Minnesota State Bike Trail, Minnesota River Water Trail, and the Minnesota River Valley Prairie Waters Birding Trail.

- Increase the quality of life for local residents who use these recreational features throughout the year by updating day use facilities and boat ramps, and creating trail connections. In some cases, improving the recreation facilities will increase safety of users.

- Educate the public through interpretive panels on a variety of subjects which could include: shallow lake ecosystems, restoration efforts, agency cooperation, safety, wildlife, history, and recreational opportunities.

- Increase the economic vitality of the area through tourism dollars from both in state and out of state recreationalists. A positive economic state and improved quality of life should help maintain and possibly boost population in this area rather than seeing a decline.

7.2.1 Description of Proposed Recreational Features

Feature 1 - Pedestrian Bridge across Marsh Lake Spillway

An immediate benefit to building a bridge over the spillway is that it will provide a safe location for fisherman and other recreationalists to cross the Minnesota River. In the future this feature would facilitate the Minnesota River State Bike Trail development and connectivity.

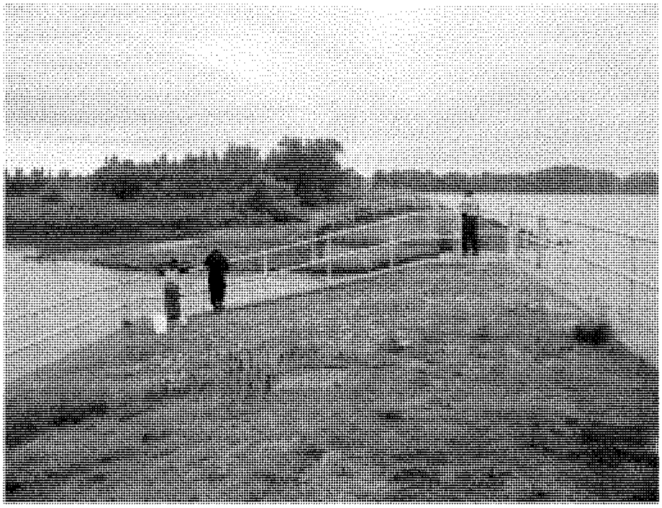


Figure 7-1. Existing Marsh Lake spillway looking south.

It is envisioned that this area will have accessible shoreline fishing platforms both on the upstream and downstream side of the spillway and dike (see Feature 2, Figures 7-2 and 7-3). Currently, recreationalists are tempted to wade or swim across the river or, in low water, walk across the structure itself. One drowning has been reported at this site. A bridge will create a safe way to cross. Conversion of the spillway to a fishway weir structure (Figure 4-4 above) would eliminate the hydraulic backroller that forms below the existing ogee crest spillway and would improve recreational public safety.

Map 2.

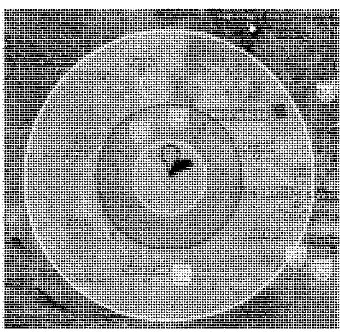


Figure 7-2. Proximity of Marsh Lake to population centers. Blue pin = Marsh Lake. Green = 40 mile radius, Blue = 80 mile radius, Yellow = 160 Mile Radius

Fishing is a popular activity at Marsh Lake. In 2006, 1.1 million state residents 16 years old and older fished in Minnesota. (National Survey of Fishing, Hunting, and Wildlife-Associated Recreation.) Within a 40 mile radius of Marsh Lake there are over 25,000 people who would have immediate access to the recreation features of this project (Figure 7-2).

The future Minnesota River State Bike Trail is broken down into segments. Segment 2 Ortonville to Appleton is located within the geographical scope of this project. Future trail alignment for this segment can be described in two parts: a loop around Big Stone National Wildlife Refuge and then, east of the refuge, an alignment on the south side of the river to the foot of Marsh Lake. It is at this point that a pedestrian bridge will provide connectivity to the State Trail which will continue south into Lac qui Parle Wildlife Management Area and connect to existing trails in Appleton. Generally the trail follows road corridors. However, it is envisioned that the Minnesota River Trail will be partially located on alignments that are separate from road rights-of-way, providing access to natural and cultural amenities along scenic routes that showcase Minnesota River valley landscape. (Minnesota River State Trail Master Plan, June 2007)

Feature 2 - U.S. Army Corps of Engineers Day Use Facility at Marsh Lake Dam Improvements

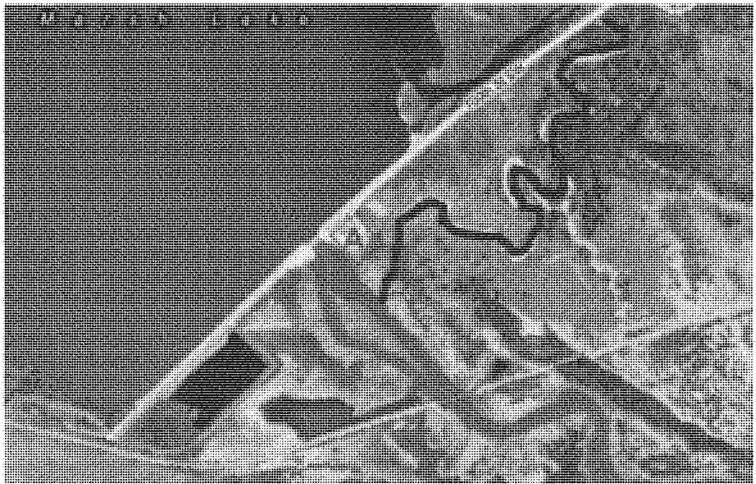


Figure 7-3. Existing day use recreation area at Marsh Lake Dam (A). Blue = Historic Pomme de Terre River channel to be restored.

The current day use facility built in 1938 needs improvements. The Ecosystem Restoration recommended plan includes rerouting the Pomme de Terre River, which will block the existing canoe landing on the Pomme de Terre River, approximately 0.5 miles east/northeast of the Marsh Lake spillway. A new canoe landing is recommended at the day use area to provide a canoe landing for both the Pomme de Terre and Minnesota Rivers. The canoe landing could be as simple as a mowed foot path leading to the water's edge with a primitive landing. When the Pomme de Terre is restored to its former channel, paddlers will then be able to paddle directly into the Minnesota River from the Pomme de Terre River without a portage. However, most paddlers will probably want to use the day use area as an exit/entry point or rest stop.

With the rerouting of the Pomme de Terre River to its historic location, the day use area will eventually be located between two flowing rivers. So in addition to the canoe access point mentioned above, it is recommended that the upgraded day use facility include:

- Picnic tables and park benches
- Vault toilets (handicapped-accessible) which have the capacity to withstand flooding.
- Shoreline fishing stations - Most should be handicapped-accessible. (See Figures A and B.)
- A safe portage across the Marsh Lake Dam from Marsh Lake to the Minnesota River in the day use area.
- Interpretive kiosk.
- Short foot path and ramp will be needed to access the pedestrian bridge across the spillway.

Note that not all public access areas on Marsh Lake are handicapped-accessible which is why more handicapped-accessibility features are recommended for the day use area.

The Marsh Lake Dam area will have a number of accessible shore fishing stations located above and below the dam on both sides of the spillway and near the mouth of the Pomme de Terre River. A safe area will be created for walk-in winter access along the dike. Flat rock/rustic fishing platforms will be installed as well as accessible concrete fishing platforms as shown in Figure 7-5.

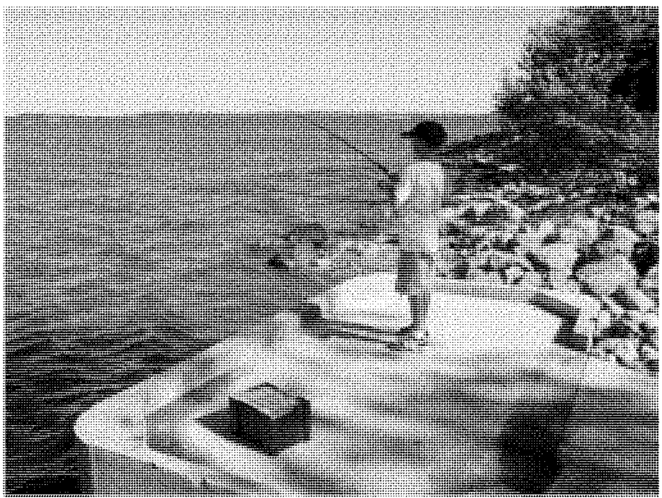


Figure 7-4. Accessible fishing platform made from a box culvert section turned on end.

Figure 7-5. Example of an accessible shore fishing platform.

Feature 3 - Boat Landing Improvements

The Minnesota DNR maintains a number of boat landings around Marsh Lake (Figure 7-6). Improvements will consist mainly of shoreline fishing structures and interpretive signage using kiosks.

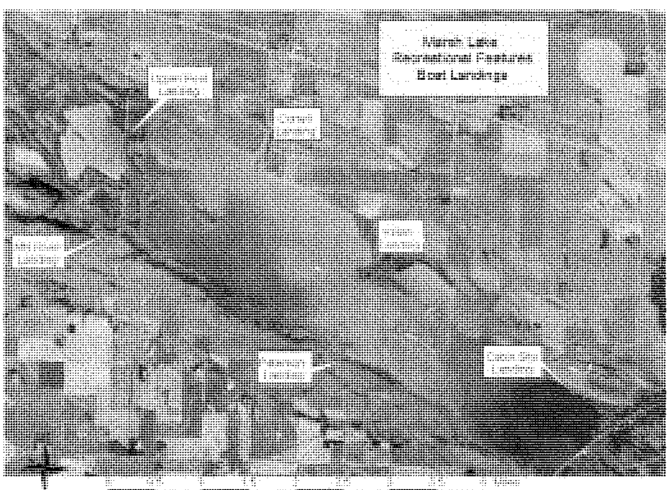


Figure 7-6. Boat landings at Marsh Lake used for hunting, fishing, and wildlife viewing.

Minnesota River Landing at the Upstream End of Marsh Lake

Proposed improvements include both shoreline fishing stations and an interpretive/educational kiosk. This site, which has the heaviest traffic, would have an interpretive kiosk highlighting the history of Marsh Lake, the current lake condition, shallow lake management, and ecosystem restoration efforts that are being taken to improve current conditions. This kiosk could also have a "you are here" type map along with any safety messages.

South Side of Minnesota River Landing

Proposed improvements would include boat access improvements including parking and accessible shore fishing stations below the bridge (Figure 7-7).

Figure 7-7. Example of an accessible trail to a shore fishing station.

North Side of Minnesota River Landing

Flat rock shore fishing stations would be installed (Figure 7-8).

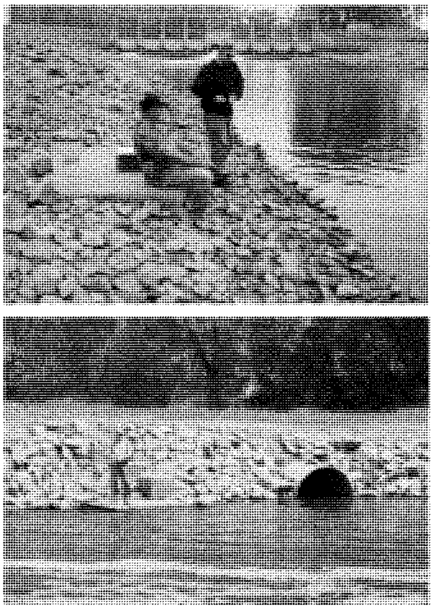


Figure 7-8. Examples of flat rock type of shore fishing stations.

Upper Pool Landing

Proposed Improvements include accessible fishing platforms similar to the Minnesota River Landing above and an interpretive/educational kiosk.

Other Four Landings: Correll, Peterson, Killen, and Cabin Site

These sites would each have a simple educational/information kiosk which would not be as elaborate as the Minnesota River Landing kiosk. The kiosks could have the same "You are Here" maps showing other boat landings but then each landing could have different educational & interpretive material such as waterfowl migration, wildlife, waterfowl feeding and resting areas, islands, wave barriers, and types of emergent vegetation. These sites would also include shoreline fishing structures which could also be used by wildlife watchers.

It is important to note that the boat landings around Marsh Lake are also the main stopping points for wildlife viewers and visitors traveling along the National Scenic Byway and Audubon Minnesota River Valley Birding Trail. Birders flock to the area. This stretch is located in one of the major waterfowl flyways in North America with thousands of birds such as blue-winged teal, mallards, pintails, and wood ducks. Marsh Lake has the largest white pelican rookery in Minnesota and one of only two nesting colonies of the white pelican in the state. As many as 10,000 pelicans, tundra swans, snow geese, and sandhill cranes can be seen migrating through the area in a single day. The Lac qui Parle Wildlife Management Area is a major stop for hundreds of thousands of Canada geese. There are over 2 million resident and non-resident wildlife watching participants in Minnesota (2006 National Survey of Fishing, Hunting, and Wildlife Associated Recreation.) A 160 mile radius around the Marsh Lake project area, or less than a 2.5 hour drive away, includes over 3.5 million people from four states (Figure 7-2).

7.2.2 Benefit Computation

Recreation benefits attributable to the proposed trail system were based on projected demand for the recreational activities listed in Table 7-8. These demand estimates over the period of analysis were used in conjunction with Unit Day Values developed for each of the recreational activities. Demand for each project year was multiplied by the appropriate Unit Day Value for each recreation activity. The value of the recreation activity at each project year was converted to a present worth value using a 4 1/8 percent annual interest rate. The sum of these present worth values, by recreational activity, were converted to an average annual dollar value, given a 50 year project life and a 4 1/8 percent annual interest rate.

Table 7-8 – Project recreation average annual benefit.

Picnicking	$	14,500
Wildlife Viewing	$	84,400
Fishing	$	89,300
Canoe/kayak	$	36,800
TOTAL ANNUAL AVG BENEFITS	**$**	**225,000**

Rounded to nearest $1000

The present value of estimated construction costs, contingencies, engineering, design, construction management, and interest during construction were calculated to be

$516,000. This present value was amortized at 4 1/8 percent over the 50-year life of the project. The resulting annualized cost of $24,000 was added to the estimated annual operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) cost of $2,000 for a total annual cost of $26,000. The net annual benefits, or the annual benefits minus the annual costs, are $199,000. The benefit-cost ratio, or the annual benefits divided by the annual costs, was calculated to be 8.6. Therefore, the Marsh Lake proposed recreation plan is economically justified. The Federal costs of the Marsh Lake Ecosystem Restoration project with the recreation facilities would be approximately 0.4 percent greater than the Federal costs of the project without the recreation facilities, less than the 10 percent limit, in accordance with ER 1105-2-100.

7.3 Real Estate Requirements

The Minnesota Department of Natural Resources (DNR) is the non-Federal sponsor for the study. The DNR has fee title to the entire lake area northwest of the dam and southeast of Corps fee title land in and around the dam. Together, the Minnesota Department of Natural Resources and U.S. Army Corps of Engineers own all land required for the project in fee title.

7.4 Monitoring and Adaptive Management

A Monitoring and Adaptive Management Plan is included in Appendix R.

<u>System Hydrology</u>

The Corps will continue to maintain gages at Marsh Lake Dam and at Lac qui Parle Dam and a continuous record of water levels and discharge.

<u>Native Mussels in the Pomme de Terre River</u>

A plan for monitoring the effects of restoring the Pomme de Terre River to its former channel on native mussels is detailed in Section 4.1.4. The 2010 mussel survey was conducted by the DNR. The post-construction monitoring will be done by the DNR.

Aquatic Vegetation in Marsh Lake

Following project construction, the DNR will conduct annual surveys of aquatic vegetation in Marsh Lake by aerial photo interpretation and by sampling from a boat as shown in Section 2.8.5. Should submersed aquatic vegetation not increase in response to the measures implemented in the tentatively recommended plan after five years, rock islands will be constructed to meet project objectives 4 and 5: Reduced sediment resuspension in Marsh Lake and Increased extent, diversity and abundance of emergent and submersed aquatic plants in Marsh Lake. A determination of the need for the rock islands will be documented through monitoring and may be recommended for construction based on adaptive management criteria found in Appendix R.

7.5 Cost Estimates

Cost estimates for the recommended plan are summarized below:

Table 7-9. Economic summary of the recommended plan (October 2011 price levels).

Breakout of Total Project Costs and Benefits Marsh Lake Ecosystem Restoration - Recommended Plan	
	Ecosystem Restoration
Total Project First Costs	$ 9,967,000
Interest During Construction (4.125%)	$ 214,000
Present Worth of Investment	**$ 10,181,000**
Annualized Total Project Costs	$ 500,000
Annual Operations and Maintenance Costs	$ 35,000
Total Annual Benefits (Habitat Units)	8400
Total Annual Benefits (Recreation)	$ 225,000

Rounded to nearest $1000

8. Compliance with Environmental Laws and Regulations

8.1 Review of Federal Laws, Regulations, Policies and Executive Orders

The St. Paul District, U.S. Army Corps of Engineers has conducted this feasibility study and NEPA process in accordance with Corps of Engineers planning guidance (ER 1105-2-100) and requirements of applicable laws and regulations (Table 8-1). We have assessed the environmental effects of the alternative plans and the proposed action on the environment (Section 6.4 above and Table 8-2).

Compliance with applicable environmental quality statutes is summarized in the table below. Full compliance for this EA is defined as having met all requirements of the statute for the current stage of planning. In some cases, further authorization and certification will be required prior to and during construction. Partial compliance indicates that information is still being collected or disseminated to and from proper agencies. Further explanation for each statute is provided below.

Table 8.1 Laws, regulations and Executive Orders applicable to planning the Marsh Lake Project and current compliance status.

Federal Policy	Compliance Status
Bald and Golden Eagle Protection Act, 42 USC 4151-4157	Partial
Clean Air Act, 42 USC 7401-7542	Full
Clean Water Act, 33 USC 1251-1375	Full[1]
Comprehensive Environmental Response, Compensation, and Liability Act, 42 USC 9601-9675	Partial
Endangered Species Act, 16 USC 1531-1543	Partial
Farmland Protection Policy Act, 7 USC 4201-4208	Full
Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (EO 12898)	Full
Federal Water Project Recreation Act, 16 U.S.C. 460-1(12), et seq.	Full
Fish and Wildlife Coordination Act, 16 USC 661-666c	Partial
Floodplain Management (EO 11988 as amended by EO 12148)	Full[1]
Food Security Act of 1985, 7 USC varies	Full
Invasive Species (EO 13112)	Partial
Land and Water Conservation Fund Act, 16 USC 460d-461	Full
Migratory Bird Treaty Act of 1918, 16 USC 703-712	Full[1]
National Environmental Policy Act, 42 USC 4321-4347	Partial
National Economic Development (NED) Plan	Full
National Historic Preservation Act, 16 USC 470 et seq.	Partial
Noise Control Act, 42 USC 7591-7642	Full
Prevention, Control, and Abatement of Air and Water Pollution at Federal Facilities (EO 11282 as amended by EO's 11288 and 11507)	Full
Protection and Enhancement of the Cultural Environment (EO 11593)	Partial
Protection of Wetlands (EO 11990 as amended by EO 12608)	Full[1]
Protection and Enhancement of Environmental Quality (EO 11991)	Full
Protection of Migratory Birds (EO 13186)	Full[1]
Resource Conservation and Recovery Act, 42 USC 6901-6987	Full
Rivers and Harbors Act, 33 USC 401-413	Full[1]
Water Resources Development Acts of 1986, 1990, 2000 and 2007	Full
Wild and Scenic Rivers Act, 16 U.S.C. 1271, et seq.	Full

[1] Further certification or authorization required prior to construction.

8.2 Economic and Environmental Principles and Guidelines

The Federal objective of water and related land resources planning is to contribute to national economic development consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements. Achievement of the Federal objective is measured in terms of contribution to Federal accounts intended to track the overall benefits of a given project. The two accounts applicable to the Marsh Lake Ecosystem Restoration are the National Economic Development (NED) account and the Environmental Quality (EQ) account.

National Economic Development (NED) Account

Contributions to national economic development (NED) are increases in the net value of the national output of goods and services, expressed in monetary units. Contributions to NED are the direct net benefits that accrue in the planning area and the rest of the nation. For an ecosystem restoration project with accompanying recreation features, the NED is calculated by the sum of the average annual costs of the ecosystem restoration features, plus the average annual benefits of the recreation features, minus the average annual costs of the recreation features. The results for the Marsh Lake Ecosystem Restoration Project are as follows:

	Total Average Annual Recreation Benefits	$	225,000
-	Total Average Annual Recreation Costs	$	26,000
	Contribution to National Economic Development Account	$	199,000

Rounded to nearest $1000

Environmental Quality (EQ) Account

EQ attributes are the ecological, cultural, and aesthetic properties of natural and cultural resources that sustain and enrich human life. Evaluation of EQ in the planning process consists of the assessment and appraisal of effects. Four general actions—define, inventory, assess, appraise—are the phases of these procedures. For ecosystem restoration projects, contributions to the EQ account are detailed through NEPA compliance and calculation of net ecosystem benefits. The Marsh Lake Ecosystem Restoration Project includes an integrated Environmental Assessment where the necessary components of a NEPA evaluation are combined within each of the planning steps. This evaluation is summarized in a qualitative summary of environmental effects detailed in Table 6-1 as well as Section 6.6 of this report. In addition, Section 5 and Appendix E of this report contain quantitative information regarding net ecosystem benefits through use of Habitat Evaluation Procedures/Habitat Suitability Index. The credit to the EQ account is the quantified benefits resulting from the project, which, in the case of the recommended plan provides a net gain of 8400 average annual habitat units over the 50-year period of analysis.

8.3 USACE Environmental Operating Principles

Properly formulated ecosystem restoration projects should be consistent with USACE Environmental Operating Principles. The analysis included in the Marsh Lake Ecosystem Restoration Project Feasibility Study report shows that implementation of the recommended plan will have a substantial benefit to the ecosystem of Marsh Lake while balancing the existing use and function of the previously authorized project. Environmental Operating Principles are listed below for reference:

1. Strive to achieve environmental sustainability. An environment maintained in a healthy, diverse and sustainable condition is necessary to support life.
2. Recognize the interdependence of life and the physical environment. Proactively consider environmental consequences of Corps programs and act accordingly in all appropriate circumstances.
3. Seek balance and synergy among human development activities and natural systems by designing economic and environmental solutions that support and reinforce one another.
4. Continue to accept corporate responsibility and accountability under the law for activities and decisions under our control that impact human health and welfare and the continued viability of natural systems.
5. Seeks ways and means to assess and mitigate cumulative impacts to the environment; bring systems approaches to the full life cycle of our processes and work.

6. Build and share an integrated scientific, economic, and social knowledge base that supports a greater understanding of the environment and impacts of our work.
7. Respect the views of individuals and groups interested in Corps activities, listen to them actively, and learn from their perspective in the search to find innovative win-win solutions to the nation's problems that also protect and enhance the environment.

8.4 Lessons Learned from Hurricanes Katrina and Rita

Following the devastation of Hurricanes Katrina and Rita, the U.S. Army Corps of Engineers drafted twelve actions for change to ensure that a systems based approach is incorporated into project planning, risk informed decision making is adopted throughout the organization, risks are adequately communicated to the public, and agency technical expertise is sufficiently leveraged. Below is a brief assessment of which of the twelve actions for change have been incorporated into the Marsh Lake Ecosystem Project Planning Process:

- **Theme 1: Comprehensive Systems Approach**
  - ✓ – Action 1: Employ integrated, comprehensive and systems-based approach
  - ✓ – Action 5: Employ adaptive planning and engineering systems
  - ✓ – Action 6: Focus on sustainability
- **Theme 2: Risk Informed Decision Making**
  - ✓ – Action 2: Employ risk-based concepts in planning, design, construction, operations, and major maintenance
  - ✓ – Action 7: Review and inspect completed works
- **Theme 3: Communication of Risk to the Public**
  - ✓ – Action 9: Effectively communicate risk
  - ✓ – Action 10: Establish public involvement risk reduction strategies
- **Theme 4: Professional and Technical Expertise**
  - – Action 3: Continuously reassess and update policy for program development, planning guidance, design and construction standards
  - ✓ – Action 4: Employ dynamic independent review
  - – Action 8: Assess and modify organizational behavior
  - – Action 11: Manage and enhance technical expertise and professionalism
  - ✓ – Action 12: Invest in research

9. Implementation Responsibilities

9.1 Federal (Corps)/Non-Federal Sponsor Implementation

Implementation of specifically authorized ecosystem restoration projects requires the participation of a non-Federal sponsor. The State of Minnesota, Department of Natural Resources (DNR) served as the non-Federal sponsor for the Feasibility phase and has indicated a strong interest in serving as the non-Federal sponsor for the Construction phase. Cost-sharing for plan implementation is subject to the rules for ecosystem restoration projects established in Section 210 of WRDA 1996. Accordingly, the non-Federal share will be 35 percent of the implementation costs. Recreation features would be cost shared 50%/50% with OMRR&R a local responsibility in accordance with the cost sharing established by WRDA 1986, as amended. Non-Federal sponsors are responsible for 100 percent of lands, easements, rights-of-way, utility or public facility relocations, and dredged or excavated material disposal areas (LERRD), and operation, maintenance, repair, rehabilitation, and replacement (OMRR&R). The value of LERRD is credited to the 35 percent share.

A breakdown of the project Federal and non-Federal sponsor costs is included below:

Table 9-1, Anticipated Total Project Costs Allocated by Fiscal Year

Anticipated Fully Funded Project Costs Allocated by Fiscal Year (Rounded to nearest $100)							
	Project First Costs Plus Contingency	Fully Funded Amount Plus Contingency	FY12	FY13	FY 14	FY 15	Total Project
Federal							
Preconstruction Engineering, Design	$ 644,500	$ 646,600	$ 646,600	$ -	$ -	$ -	$ 646,600
Construction Management	$ 405,400	$ 418,100	$ -	$ 173,400	$ 227,700	$ 17,000	$ 418,100
Construction	$ 5,346,300	$ 5,517,600	$ -	$ 2,288,300	$ 3,005,400	$ 223,900	$ 5,517,600
Federal LERRD	$ 6,600	$ 6,600	$ 6,600	$ -	$ -	$ -	$ 6,600
Total Federal	$ 6,402,800	$ 6,588,900	$ 653,200	$ 2,461,700	$ 3,233,100	$ 240,900	$ 6,588,900
Non-Federal							
Preconstruction Engineering, Design	$ 359,100	$ 361,000	$ 361,000	$ -	$ -	$ -	$ 361,000
Construction Management	$ 224,500	$ 232,900	$ -	$ 93,300	$ 122,600	$ 17,000	$ 232,900
Construction	$ 2,977,000	$ 3,074,400	$ -	$ 1,232,200	$ 1,618,300	$ 223,900	$ 3,074,400
Non-Federal LERRD Cost-Share	$ 3,600	$ 3,600	$ 3,600	$ -	$ -	$ -	$ 3,600
Total Non-Federal	$ 3,564,200	$ 3,671,900	$ 364,600	$ 1,325,500	$ 1,740,900	$ 240,900	$ 3,671,900
Total Project	$ 9,967,000	$ 10,260,800	$ 1,017,800	$ 3,787,200	$ 4,974,000	$ 481,800	**$ 10,260,800**

Table 9-2, Apportionment of Project First Costs

Apportionment of Project First Costs Between Federal and Non-Federal Sponsor			
	Federal	Non-Federal	Total
Ecosystem Restoration Features			
Preconstruction Engineering, Design	$ 619,000	$ 333,000	$ 952,000
Construction Management	$ 392,000	$ 211,000	$ 604,000
Construction	$ 5,133,000	$ 2,764,000	$ 7,897,000
LERRD	$ 7,000	$ 3,000	$ 10,000
Total Ecosystem Restoration	**$ 6,151,000**	**$ 3,311,000**	**$ 9,463,000**
Recreation Features			
Preconstruction Engineering, Design	$ 26,000	$ 26,000	$ 52,000
Construction Management	$ 13,000	$ 13,000	$ 26,000
Construction	$ 213,000	$ 213,000	$ 426,000
LERRD	$ -	$ -	$ -
Total Recreation Features	**$ 252,000**	**$ 252,000**	**$ 504,000**
Total Project	**$ 6,403,000**	**$ 3,563,000**	**$ 9,967,000**
Rounded to nearest $1000			

9.2 Real Estate Requirements

A real estate plan is included in this report as a stand-alone document in Appendix M. Because the entire project will be constructed on lands owned by the State and Federal government, no real estate acquisition is required for this project.

10. Coordination

10.1 Public Involvement

The State of Minnesota, Department of Natural Resources (DNR) has been actively involved in planning the Marsh Lake project over the course of the previous twelve years. Public involvement regarding conditions at Marsh Lake pre-dates the Marsh Lake Feasibility study. The Corps and the DNR worked together in 1999 and 2000 to consider potential modifications to the Marsh Lake Dam. As a part of that effort, approximately 50 citizens attended a public meeting on July 27, 2000 and provided 39 written comment sheets. No consensus was reached on desired actions at that time, but the public input was used to inform further discussions within the DNR. The DNR began a public planning process on November 9, 2000 to define problems and issues at Marsh Lake. This planning process ultimately served as the foundation for the current Corps Feasibility Study Report and State-Federal partnership.

A public review period was conducted from May 17, 2011 to June 25, 2011. A press release was issued, the project web site was updated with a copy of the project report and a video overview, and hard copies of the report were made available at two of the local libraries near the project location.

On May 26, 2011, project delivery team members conducted a series of meetings on site with stakeholders and the public to solicit input on the draft Feasibility Study Report during the public review period. Organizations in attendance included U.S. Fish and Wildlife Service staff, the Appleton Sportsman's Club, the Lac qui Parle Association, Coalition for a Clean Minnesota River (CCMR), Ducks Unlimited, the Upper Minnesota Valley Regional Development Commission, CURE (Clean Up the River Environment) as well as members of the general public. The project delivery team provided presentations about the project development process, the problems and opportunities, and the recommended plan. A question and answer period followed the presentation. The project was generally well-received with many of the participants showing support for the recommended plan. No negative comments were subsequently received during the review period and therefore no outstanding issues requiring resolution were identified during the review.

10.2 Federal Agencies

The U.S. Fish and Wildlife Service participated in the planning of the Marsh Lake project and has been consulted on endangered species and has provided a letter in compliance with the Fish and Wildlife Coordination Act.

The U.S. Environmental Protection Agency, the U.S. Geological Survey, and the U.S. Department of Agriculture will be provided copies of the final Feasibility Report and Environmental Assessment for review.

Per 36 CFR § 800.6, the Corps will notify the Advisory Council on Historic Preservation of the adverse effects of the ecosystem restoration measures on the National Register-eligible Marsh Lake Dam and request their participation in the Memorandum of Agreement to mitigate those adverse effects.

10.3 State Agencies

The DNR has been actively involved in planning the Marsh Lake project and provided much of the information contained in this report. Public involvement regarding conditions at Marsh Lake pre-dates the Marsh Lake Feasibility study. The Corps and the DNR worked together in 1999 and 2000 to consider potential modifications to the Marsh Lake Dam. As a part of that effort, approximately 50 citizens attended a public meeting on July 27, 2000 and provided 39 written comment sheets. No consensus was reached on desired actions at that time, but the public input was used to inform further discussions within the DNR. The DNR began a public planning process on November 9, 2000 to define problems and issues at Marsh Lake. A public meeting was held on March 1, 2001 that generated 30 written comment sheets from over 50 attendees. Following the meeting, the DNR assembled a 10-member Marsh Lake Citizen Group to serve as a "sounding board," assist with generating ideas, develop public participation strategies, and communicate with other citizens and stakeholder groups. The Citizen Group met on April 3, 2001; July 13, 2001; February 6, 2002; and June 30, 2003. Press releases and informational mailings were sent periodically to a list of over 100 individuals, news organizations, environmental organizations, local governmental units and state agencies. On June 12, 2003, DNR officials signed an internal "Agreement in Principle" to document the strategies that were discussed by the Citizen Group and supported by the DNR's Divisions of Ecological Services, Fisheries and Wildlife to improve conditions on Marsh Lake. A final public meeting was held on August 26, 2003 to share the results of the DNR's planning process with the public.

The 2008 Phase I cultural resources survey of the Marsh Lake ecosystem restoration feature locations conducted by DNR archeologists was coordinated with the Minnesota State Historic Preservation Office. The SHPO responded that a Phase II evaluation of the National Register eligibility of site 21BS67 is needed prior to shoreline protection along that island's shoreline and the effects of the project on Marsh Lake Dam need to be assessed (SHPO letter dated February 20, 2009). The Corps has since consulted with the Minnesota SHPO and has prepared a Memorandum of Agreement covering mitigation of adverse effects to the National Register-eligible Marsh Lake Dam in order to comply with Section 106 of the National Historic Preservation Act and its implementing regulations, 36 CFR Part 800, Protection of Historic Properties.

A 401 Water Quality Certification is currently in the process of being obtained from the Minnesota Pollution Control Agency. A Minnesota Pollution Control Agency National Pollutant Discharge Elimination System (NPDES) Construction Stormwater (CSW) Permit for construction activities associated with the Recommended Plan may also be required.

10.4 Native American Tribes

Letters to initiate consultation of the Marsh Lake ecosystem restoration project with the Sisseton-Wahpeton Oyate of Lake Traverse Reservation in South Dakota, the Upper Sioux Community of Minnesota, and the Lower Sioux Indian Community of Minnesota under Section 106 of the National Historic Preservation Act, as amended, were sent to their tribal chairmen on December 12, 2008. Copies of these signed letters were sent to their respective Tribal Historic Preservation Officer or tribal cultural resources point-of-contact. The tribes were contacted again as part of the public review process. As of June 25, 2011, there has been no response from any of these tribes.

10.5 Local Units of Government and Non-Governmental Organizations

Local units of government in the counties adjoining the Marsh Lake project area and non-governmental organizations participated in early stages of project planning in a series of meetings with the DNR. As a part of the public review process for the draft Feasibility report, local governments and non-governmental organizations were provided the link to copies of the draft report for review and commentand also invited to a public meeting to discuss the proposed project.

11. Recommendation

As District Engineer, I have considered the environmental, social, and economic effects, the engineering feasibility, and comments received from the other resource agencies, the non-federal sponsors, and the public, and have determined that the selected plan presented in this report is in the overall public interest and is technically sound, environmentally acceptable, and economically feasible. I recommend that the selected plan and associated features described in this report be authorized for implementation as a federal project.

The selected plan is the National Ecosystem Restoration Plan with a separately formulated recreation plan and appropriate mitigation measures as generally described in this report. The plan includes ecosystem restoration features including but not limited to rerouting the Pomme de Terre River to its historic channel, modifying the Marsh Lake Dam to achieve target water levels and fish passage, construction of a drawdown water control structure at the Marsh Lake Dam, installation of gated culverts at Louisburg Grade Road, and the breaching of a dike at an abandoned fish pond adjacent to the Marsh Lake Dam. The plan also contains recreation features including but not limited to shoreline fishing access structures, interpretive signage, a canoe landing, benches, picnic tables, trash receptacles, toilets, and parking lot improvements.

The estimated total project first costs of the selected plan is $9,967,000 and the estimated annual operations, maintenance, repair, rehabilitation, and replacement (OMRR&R) cost is $35,000. The Federal portion of the estimated total project first costs is $6,403,000. The non-Federal sponsor's portion of the required cost share of total project first costs is $3,564,000. The estimated costs of the ecosystem restoration portion of the project are $6,151,000 Federal and $3,311,000 non-Federal. The estimated costs of the recreation features are $252,000 Federal and $252,000 non-Federal. The ecosystem restoration features of the selected plan will provide an estimated 8400 net increase in average annual habitat units (AAHU's) and the recreation features have an overall benefit-cost ratio of 8.6.

The project will modify one existing Federal project at the Marsh Lake Dam, authorized as the Lac qui Parle Water Control Project under the Flood Control Act of 1936, Public Law 74-738. The modification of this project will not impact its authorized purpose.

These recommendations are made with the provision that, prior to implementation, the non-federal sponsors will agree to comply with the following requirements:

a. Provide 35 percent of total ecosystem restoration costs as further specified below:

    1. Provide 25 percent of design costs allocated by the Government to ecosystem restoration in accordance with the terms of a design agreement entered into prior to commencement of design work for the recreation features;

    2. Provide, during the first year of construction, any additional funds necessary to pay the full non-federal share of design costs allocated by the Government to ecosystem restoration;

    3. Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct all improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material all as determined by the Government to be required or to be necessary for the construction, operation, and maintenance of the project;

    4. Provide, during the design and implementation phase, any funds necessary to make its total contribution equal to 35 percent of total project costs;

b. Provide 50 percent of total recreation costs as further specified below:

    1. Provide 25 percent of design costs allocated by the Government to recreation in accordance with the terms of a design agreement entered into prior to commencement of design work for the recreation features;

2. Provide, during the first year of construction, any additional funds necessary to pay the full non-federal share of design costs allocated by the Government to recreation;

3. Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct all improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material all as determined by the Government to be required or to be necessary for the construction, operation, and maintenance of the recreation features;

4. Provide, during construction, any additional funds necessary to make its total contribution for recreation equal to 50 percent of total recreation costs;

5. Provide, during construction, 100 percent of the total recreation costs that exceed an amount equal to 10 percent of the Federal share of total ecosystem restoration costs;

c. Provide, during the design and implementation phase, 100 percent of all costs of planning, design, and construction for the project that exceed the Federal share of the total project costs;

d. Shall not use funds from other Federal programs, including any non-Federal contribution required as a matching share therefore, to meet any of the non-Federal obligations for the project unless the Federal agency providing the Federal portion of such funds verifies in writing that expenditure of such funds for such purpose is authorized by Federal law;

e. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on project lands, easements, and rights-of-way or the addition of facilities which might reduce the outputs produced by the project, hinder operation and maintenance of the project, or interfere with the project's proper function;

f. Shall not use the project or lands, easements, and rights-of-way required for the project as a wetlands bank or mitigation credit for any other project;

g. Comply with all applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended (42 U.S.C. 4601-4655), and the Uniform Regulations contained in 49 Code of Federal Regulations (CFR) Part 24, in acquiring lands, easements, and rights-of-way required for construction, operation, and maintenance of the project, including those necessary for relocations, the borrowing of materials, or the disposal of dredged or excavated material; and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;

h. For so long as the project remains authorized, operate, maintain, repair, rehabilitate, and replace the project, or functional portions of the project, including any mitigation features, at no cost to the Federal Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government;

i. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the project for the purpose of completing, inspecting, operating, maintaining, repairing, rehabilitating, or replacing the project;

j. Hold and save the United States free from all damages arising from the design, construction, operation, maintenance, repair, rehabilitation, and replacement of the project and any betterments, except for damages due to the fault or negligence of the United States or its contractors;

k. Keep and maintain books, records, documents, or other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, or other evidence are required, to the extent and in such detail as will properly reflect total project costs, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 CFR Section 33.20;

l. Comply with all applicable Federal and State laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d) and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army"; and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141- 3148 and 40 U.S.C. 3701 – 3708 (revising, codifying and enacting without substantial change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a *et seq.*), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 *et seq.*), and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c *et seq.*);

m. Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 96-510, as amended (42 U.S.C. 9601-9675), that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for construction, operation, and maintenance of the project. However, for lands that the Federal Government determines to be subject to the navigation servitude, only the Federal Government shall perform such investigations unless the Federal Government provides the non-Federal sponsor with prior specific written direction, in which case the non-Federal sponsor shall perform such investigations in accordance with such written direction;

n. Assume, as between the Federal Government and the non-Federal sponsor, complete financial responsibility for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for construction, operation, and maintenance of the project;

o. Agree, as between the Federal Government and the non-Federal sponsor, that the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, repair, rehabilitate, and replace the project in a manner that will not cause liability to arise under CERCLA;

p. Provide, during the design and implementation phase, 35 percent of all costs that exceed $50,000 for data recovery activities associated with historic preservation for the project; and

q. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended (42 U.S.C. 1962d-5b), and Section 103(j) of the Water Resources Development Act of 1986, Public Law 99-662, as amended (33 U.S.C. 2213(j)), which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until each non-Federal interest has entered into a written agreement to furnish its required cooperation for the project or separable element.

FINAL REPORT

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and implementation funding. However, prior to transmittal to Congress, the non-federal sponsor, the State of Minnesota, interested Federal agencies, and other parties will be advised of any modifications and will be afforded the opportunity to comment further.

Michael J. Price
Colonel, Corps of Engineers
District Engineer

15 July 2011
Date

12. Finding of No Significant Impact

DEPARTMENT OF THE ARMY

ST. PAUL DISTRICT, CORPS OF ENGINEERS
180 FIFTH STREET EAST, SUITE 700
ST. PAUL, MN 55101-1678

REPLY TO
ATTENTION OF

Environmental and Economic Analysis Branch
Planning, Programs and Project Management Division

FINDING OF NO SIGNIFICANT IMPACT

In accordance with the National Environmental Policy Act, the St. Paul District, Corps of Engineers, has assessed the environmental impacts of the following project:

ECOSYSTEM RESTORATION
MARSH LAKE, BIG STONE, LAC QUI PARLE AND SWIFT COUNTIES, MINNESOTA

The intent of this project is to provide ecosystem restoration to Marsh Lake, a part of the Lac qui Parle reservoir in Big Stone, Lac qui Parle and Swift Counties, Minnesota. The proposed project involves modification of a dam at the Marsh Lake outlet, rerouting of the Pomme de Terre River, and associated hydrologic modifications in and around Marsh Lake. This finding of no significant impact is based on the following factors: the project would have no adverse impacts on fish and wildlife resources, and the project would have only short-term minor negative impacts on the social environment, State-listed threatened or endangered species and on air quality. The project would substantially benefit wetland habitat, habitat diversity and interspersion, biological productivity and surface water quality and have minor benefits to recreation, public health and safety, and public facilities and services. Continued coordination, particularly regarding cultural resources, would be maintained with appropriate State and Federal agencies.

For the reasons stated above, the proposed action does not constitute a major Federal action significantly affecting the quality of the human environment. Therefore, an environmental impact statement will not be prepared.

6 JAN 2012
Date

Michael J. Price
Colonel, Corps of Engineers
District Engineer

13. List of Preparers

The following table includes the St. Paul District Corps of Engineers and Minnesota DNR Project Delivery Team members who contributed to this report and EA.

Team Members	**Discipline**
Corps of Engineers	
Michael Wyatt	**Planner/Project Manager**
Corby Lewis	**Hydraulic Engineering**
Scott Goodfellow	
Daniel Wilcox	**Aquatic Ecology, Planning**
Lance Awsumb	**Economics, Sociology**
Ginny Gnabasik	**Cultural Resources**
Rodney Peterson	**Real Estate**
Dave Tschida	**Design/Civil Engineering**
Chris Behling	**Geotechnical Engineering**
BJ Siljenberg	**Structural Engineering**
Renee McGarvey	**Recreation**
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David Trauba	**Wildlife**
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Other Partners	
Josh Kavanagh	**Ducks Unlimited**
Dick Kroger	**CURE**
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Appendices

A. Project Management Plan
B. Federal Cost Sharing Agreement
C. Correspondence
D. Clean Water Act, Section 404(b)(1) Evaluation
E. Habitat Benefits Evaluation
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FINAL REPORT

US Army Corps of Engineers
St. Paul District
Mississippi Valley Division

Feasibility Report Appendices

Marsh Lake Ecosystem Restoration Project

Minnesota River

Big Stone, Lac qui Parle, and Swift Counties, Minnesota

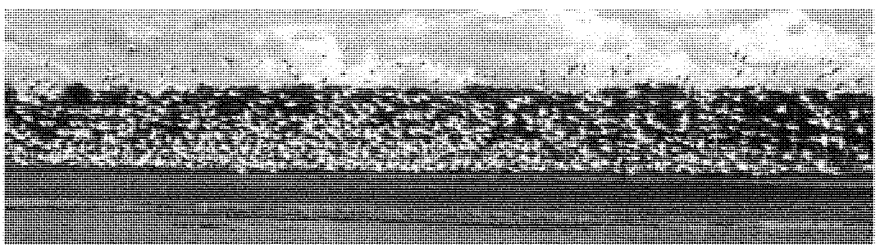

Photo by Ron Bolduan

Completed in conjunction with the Minnesota Department of Natural Resources

July 2011

Appendix A – Project Management Plan

MARSH LAKE ECOSYSTEM RESTORATION PROJECT
Minnesota River
FEASIBILITY STUDY

PROJECT MANAGEMENT PLAN

Revised: December 10, 2010

1. Purpose.

a. The purpose of this document is to identify the scope, schedule and budget for the Marsh Lake Ecosystem Restoration Feasibility Study. The study will evaluate a variety of measures to restore the ecosystem in Marsh Lake, an impoundment on the Minnesota River near Appleton, Minnesota. This document will serve as the Project Management Plan attached to the Feasibility Cost Sharing Agreement (FCSA) between the Corps and the non-federal Sponsor. (Note: the FCSA refers to this document as the "Project Stndy Plan.") This document also establishes quality control expectations and procedures to ensure that the study products meet applicable standards.

b. This project management plan, hereinafter referred to as the PMP, defines the planning approach, activities to be accomplished, schedule, and associated costs that the Federal Government, the non-federal Sponsor, and other non-federal study partners will be supporting financially. The PMP, therefore, defines a contract between the Corps and the non-federal Sponsor, and reflects a "buy in" on the part of all the financial backers, as well as those who will be performing and reviewing the activities involved in the feasibility study. The PMP describes the initial tasks of the feasibility phase, continues throngh the preparation of the final feasibility report, the project management plan for project implementation and design agreement, and concludes with support during the Washington-level review of the final feasibility report.

c. The PMP is a basis for change. Because planning is an iterative process without a predetermined outcome, more or less time and costs may be required to accomplish reformulation and evaluations of the alternatives. Changes in scope will occur as the technical picture unfolds. With clear descriptions of the scopes and assumptions outlined in the PMP, deviations are easier to identify, the impact in either time or money is easily assessed, and decisions can be made on how to proceed.

d. The PMP is a basis for the review and evaluation of the feasibility report. Since the PMP represents a contract between the Corps and the non-federal Sponsors, it will be used as the basis to determine if the draft feasibility report has been developed in accordance with established procedures and previons agreements. The PMP reflects mutual agreements of the district, division, Sponsor and HQUSACE into the scope, critical assumptions, methodologies, and level of detail for the activities that are to be conducted during the feasibility study. Review of the draft report will be to iusure that the study has been developed consistent with these agreements. The objective is to provide early assurance that the project is developed in a way that can be supported by higher headquarters.

e. The PMP is a study management tool. It includes scopes of work that are used for funds allocation by the project manager. It forms the basis for identifying commitments between the non-Federal Sponsor and the Federal government aud serves as a basis for performance measurement.

2. Applicability. This PMP covers the feasibility stage of the project.

3. References.

a. Minnesota River Basin Reconnaissance Study, Section 905(b) (WRDA 1986) Analysis, Minnesota, South Dakota, North Dakota, and Iowa, dated December 2004 and approved January 13, 2005.

b. Feasibility Cost Sharing Agreement, Marsh Lake Feasibility Study, (Draft as of 02-May-07)

4. General/Background.

a. The Marsh Lake Feasibility Study was recommended in the December 2004 Minnesota River Reconnaissance study (approved January 13, 2005) and is authorized by a May 10, 1962 resolution of the House Committee on Public Works. Federal (Corps of Engineers) interest in Marsh Lake is based on the potential benefits of aquatic ecosystem restoration and the fact that the existing Marsh Lake Dam is owned and operated by the Corps of Engineers.

b. The Minnesota Department of Natural Resources (DNR) is sponsoring the study. The official Sponsor must sign the Feasibility Cost Sharing Agreement and provide 50% of all study costs through non-federal cash and in-kind contributions. The Corps of Engineers funds the remaining 50% of study costs.

c. The planning objectives are to restore aquatic and riparian habitat in Marsh Lake and restore connectivity between Lac qui Parle and the Pomme de Terre River. Marsh Lake is a shallow 5,000 acre reservoir with an average depth of approximately 3 feet. The Marsh Lake Dam, built by the Works Progress Administration in 1938, has a fixed crest elevation. The dam increased lake-like fish and wildlife habitat and created new colonial waterbird habitat, but it also disrupted natural flood plain functions and processes and blocked fish movement. The lack of natural flooding and drying cycles combined with increased sedimentation in the reservoir have caused a decline in plant diversity, water quality and associated fish and wildlife benefits over the years since the dam was built.

d. The study will evaluate a wide range of measures, including but not limited to those described in the "Agreement in Principle" signed by DNR Senior Managers in June 2003 (see Attachment A). The major features include modifying the Marsh Lake Dam to allow for periodic drawdowns, fish passage and more natural variation in water surface; returning the Pomme de Terre River to its pre-dam alignment; installation of breakwater structures to reduce sediment resuspensiou within the lake; and developing a management plan to define how the new features would be used. The study will also investigate policy issues and cost sharing requirements for implementation, considering the current Federal ownership of the dam and implications for future operation and maintenance responsibilities. The study team recognizes that many of the problems in Marsh Lake are symptoms of larger watershed issues. However, the team has chosen to limit the scope of this study to actions within the Lac qui Parle Wildlife Management Area. The study team believes that modifications in the vicinity of the dam and Marsh Lake are critical to restoring more natural habitat conditions. Opportunities to further enhance Marsh Lake habitat using actions in the greater watershed will be explored outside of this study.

e. The study will be conducted as outlined below. See Attachment B for a more detailed workflow plan.

1) <u>Specify Problems and Opportunities</u>: Meet with study team and others to refine problems and opportunities identified in the Reconnaissance Report and prior planning documentation. Conduct the National Environmental Policy Act (NEPA) scoping process.

2) <u>Inventory and Forecast Future Conditions</u>: Assess the existing condition of the Marsh Lake Dam and reservoir: foundation, structural integrity, hydraulic conditions, biodiversity, habitat conditions, water quality, etc. Obtain necessary field data, including but not limited to topographic surveys, sediment samples, and borings. Determine the "without project condition" of the Marsh Lake ecosystem.

3) <u>Formulate Alternative Plans</u>: Identify a system of structural and/or non-structural measures, strategies, or programs to alleviate problems or take

advantage of specific opportunities associated with water and related land activities within the project area.

4) Evaluate Effects of Alternative Plans: Assess the effects of combinations of measures to meet the planning objectives. Identify significant effects from institutional, public and technical perspectives. Conduct public involvement activities, coordinate with State and Federal agencies, and meet NEPA process requirements.

5) Compare Alternative Plans: Contrast the merits of identified alternatives with benefits, costs, effectiveness, and efficiency in meeting planning objectives .

6) Select a recommended plan: Select plan from identified alternatives and document.

7) Complete engineering investigations, geotechnical designs, mapping, hydraulics and hydrology, structural design, etc.

8) Prepare the feasibility study report and appendices for submission to Corps higher authorities to support a project recommendation to Congress.

    a. The study is estimated to cost $1,072,000,000 as detailed in Attachment C.

5. Technical Criteria Statement. This study will be conducted in accordance with Corps of Engineers criteria for Feasibility studies contained in the planning guidance notebook, ER 1105-2-100, and other applicable regulations and guidance. The final product will be a feasibility report documenting the study findings and National Environmental Policy Act (NEPA) determinations and making appropriate recommendations to Higher Authorities.

6. Quality Control.

a. This document is intended to serve as the Project Management Plan and the Quality Control Plan. The coordination, preparation and vertical team review of this scope of work assists in maintaining quality control.

b. Agency Technical Review (ATR) is the primary method of quality control. ATR review will be ongoing through product development, rather than a cumulative review performed at the end of the investigation. The ATR review will be performed by a sister Corps District in coordination with the Ecosystem Restoration Planning Center of Expertise. The ATR team will include one person from a Division other than Mississippi Valley Division. The expertise and technical backgrounds of the ATR team members will qualify them to provide a comprehensive technical review of the product. The following disciplines will be required for the ATR team: hydraulics/hydrology, geotechnical engineering, general engineering/layout, structural engineering, cost engineering, plan formulation and environmental.

c. ATR comments and responses will be recorded in the online Dr. Checks system (www.projnet.org). Documentation of the independent technical review will be included with the submission of the reports to Mississippi Valley Division and HQUSACE. All comments resulting from the independent technical review will be resolved prior to forwarding the feasibility study to higher authority and local interests. The report will be accompanied by a certification, indicating that the independent technical review process has been completed and that all technical issues have been resolved.

d. Value Engineering Plan. Value Engineering (VE) evaluations provide another method for ensuring quality. The goal of VE on this project is to ensure that a full array of alternatives is considered in order to maximize cost effectiveness. A VE study will be conducted during the plan formulation before the final array of alternatives has been defined. The VE study objectives will be to build upon the design team's preliminary plan formulation efforts, clarify the functional requirements of project features, and recommend additional conceptual alternatives to meet those requirements. The same team that performs ATR will conduct the VE study with additional technical representatives from the Sponsor. Sponsor participation will be an item of in-kind services.

e. Quality control will also be monitored via internal/District functional element reviews, Local Sponsor reviews, and Higher Authority/vertical team conferences and reviews.

f. The Sponsor will be responsible for quality control over deliverables provided as in-kind contributions. The Corps will verify that such contributions meet negotiated requirements and standards before granting cost-sharing credit for those contributions.

g. Review Plan. This feasibility study will not be subject to Independent External Peer Review (IEPR). The study is not anticipated to generate influential scientific information that would be either controversial or of sufficient risk and magnitude as to require Independent External Peer Review as described in Engineering Circular 1165-2-209. The draft feasibility report and environmental assessment will be distributed for public review as part of the normal NEPA review process. The review will be scheduled after the Alternative Formulation Briefing and before submitting the report to the Civil Works Review Board in accordance with the study schedule defined in the Project Management Plan.

<u>7.</u> <u>Risk Assessment</u>. The following issues could lead to delays or increased costs:

a. Inadequate funding: Less funding is likely to be available each year than would be necessary for optimal progress on study tasks. Delays in funding (either federal or non-federal) will result in inefficiencies in the planning process and overall increased cost.
b. Sensitive environmental or cultural resources: Particular attention will be paid to environmental issues throughout the study to ensure that project recommendations are implementable.

c. Weather conditions: certain tasks, including but not limited to surveying, archeological investigations, biological surveys and similar assessments are weather-sensitive. These tasks will be scheduled to take advantage of anticipated weather conditions. If these tasks are delayed due to funding or other issues, the delay may significantly impact completion of the study on schedule.

<u>8.</u> <u>Acquisition Plan</u>. Work required for this study will be accomplished mainly by in-house Corps staff and non-federal in-kind services. Portions of the study will be accomplished by private firms under existing Indefinite Delivery Contracts with the Corps of Engineers. Services may also be obtained through small purchase actions when appropriate. The following major contracted acquisitions are anticipated:

a. Sediment sampling and testing ($20,000)
b. Geotechnical borings and testing ($50,000)

<u>9.</u> <u>Communication Plan</u>. The communication plan addresses internal project delivery team (PDT) and external communications.

a. Internal PDT Communications: PDT distribution lists will be established that include all in-house team members, Sponsors, and other stakeholders. All general project notifications will be delivered using these distribution lists. The project manager will determine which correspondence is appropriate for each audience. E-mail will be the primary mode of communication within the PDT.

b. External communications: All news releases will be coordinated with St. Paul District Public Affairs. An initial release announcing the start of the study will be made after the cost-sharing agreement is signed. Subseqnent releases to announce public meetings will be made as needed. Other releases will be considered as the study develops. Postings on the St. Paul District's website and the DNR's sites will also be used to communicate to the general public.

c. A pre-product customer survey will be conducted at the initial team meeting. A post-product customer survey will be completed after the study is finalized.

d. Public luvolvement: Public involvement will include one NEPA scoping meeting early in the study and an informational meeting after the draft report has been distributed for public review. These meetings will be planned, facilitated, publicized and documented by the Sponsor as work-in-kind. Additional public involvement will include hosting additional meetings as appropriate, and preparing news releases, on-line newsletter articles, and web pages. The Sponsor will perform the majority of these activities as work-in-kind and coordinate with St. Paul District Public Affairs.

10. Change Management Plan.

a. All changes to the scope, schedule or budget for this study must be coordinated with the Project Manager. Whenever it becomes apparent that the current budget or schedule is likely to be inadequate, project delivery team (PDT) members must notify the Project Manager so appropriate actions can be taken. The PMP is intended to be a living, flexible document, but it also represents a contract between the Corps and the non-federal Sponsor; therefore, changes must be coordinated before obligations are incurred by any party.
b. The Project Manager, in consultation with the Study Management Team and Executive Committee, will decide whether proposed changes are acceptable. The Project Manager will revise the PMP as necessary to reflect approved changes.

11. Project Delivery Team.

a. Executive Committee: The Sponsor and the Government will appoint named senior representatives to an Executive Committee, according to the Feasibility Cost Sharing Agreement (FCSA). The executive committee will include the St. Paul District's Chief, Planning, Programs and Project Management Division and the Director of the Fish and Wildlife Division, Minnesota Department of Natural Resources. The Executive Committee will function as described in the FCSA.

b. Study Management Team: The Executive Committee will appoint representatives to serve on a Study Management Team. The Study Management Team will keep the Executive Committee informed of the progress of the Study and of significant pending issues and actions, and shall prepare periodic reports on the progress of all work items identified in the PMP. The Study Management Team will include the St. Paul District's project manager and appropriate counterparts from the Minnesota Department of Natural Resources.

c. Sponsor and key study stakeholders:

Name	Organization	Phone	E-mail
Sponsor's Primary Representatives			
Varland, Ken	MN DNR, Wildlife	(507) 359-6030	ken.varland@dnr.state.mn.us
Aadland, Luther	MN DNR, Ecological Services	(218) 739-7449	luther.aadland@dnr.state.mn.us
Haukos, Norm	MN DNR Fisheries	(320) 839-2656	norm.haukos@dnr.state.mn.us
Trauba, David	MN DNR, Wildlife	(320) 734-4451	david.trauba@dnr.state.mn.us
John Schladweiler	MN DNR, Wildlife	(507) 359-6031	john.schladweiler@dnr.state.mn.us
Key Stakeholders			
Gelvin-Innvaer, Lisa	MN DNR	(507) 359-6033	lisa.gelvin-innvaer@dnr.state.mn.us
Fouchi, Cathi	MN DNR	(507) 359-6034	cathi.fouchi@dnr.state.mn.us
Lauer, Jack	MN DNR	(507) 359-6047	jack.lauer@dnr.state.mn.us
Popp, Walt	MN DNR	(651) 345-3331	walter.popp@dnr.state.mn.us
Kolander, Todd	MN DNR, Ecological Services		todd.kolander@dnr.state.mn.us
Kavanagh, Josh	Ducks Unlimited	(320) 220-1718	jkavanagh@duck.org
Kroger, Dick	CURE	(507) 768-3608	kroger@frontiernet.net
Moore, Patrick	CURE Executive Director	(320) 269-2984	cure-ed@info-link.net

d. St. Paul District Project Delivery Team:

Name	Discipline	ORG	Phone*	E-mail**
Thury, Theresa	PM-P, Programs	B6H4100	5309	theresa.j.thury
Wyatt, Michael	PD-F, Planning/Project Mgmt	B6H4200	5216	michael.d.wyatt
	PM-E, Env and Econ	**B6H4300**		
Awsumb, Lance	Economics		5379	lance.g.awsumb
Wilcox, Dan	Environmental		5276	daniel.b.wilcox
Gnabasik, Virginia	Cultural		5262	virginia.r.gnabasik
LeClaire, Keith	GIS		5491	keith.r.leclaire
	EC-D, Cost&Specs&General	**B6L1DCS**		
Bray, Matt	Cost & Specs		5647	matthew.m.bray
Tschida, David	General Engineering		5585	david.m.tschida
Behling, Chris	EC-D, Geotech	B6L1DGG	5572	christopher.w.behling
	EC-D, SMEA	**B6L1DSM**		
Sauser, Phillip	Structures		5722	phillip.w.sauser
TBD	Mechanical			
TBD	Electrical			
Lewis, Corby	EC-H, Hydraulics	B6L1HHC	5635	corby.r.lewis
Chamberlin, Ferris	EC-H, Water Control & Hydrology	B6L1HWC	5619	ferris.w.chamberlin
Peterson, Ken	RE-PA, Planning & Appraisal	B6N0PA0	5359	kenneth.j.peterson
Linder, Dawn	CT-C, Contracts	B6P0A00	5407	dawn.m.linder
Bertschi, Tim	OP-RNW, Recreation and NR Project Office		701-232-1894	tim.s. bertschi
Melby, Randy	OP-RNW, Lac Qui Parle Project		320-269-6303	randy.d.melby

* All Phone numbers begin with "**651-290**" unless shown otherwise.
** All e-mail addresses end with "**@usace.army.mil**"

12. Customer Involvement/in-kind services. The Sponsor and other stakeholders will be intimately involved in this study. Some of that involvement may qualify for credit against the non-federal cost-share as in-kind services, as detailed below.

a. In-kind services (work-in-kind) are locally provided services and/or supplies that the Sponsor may provide to offset a portion of their cost share for the feasibility study. The use of in-kind services in lieu of cash for feasibility studies is authorized by Section 105 of the Water Resources Development Act of 1986, as amended. Work-in-kind is an option for the Sponsor within certain guidelines, and the value of the actual costs of negotiated in-kind services can reduce the Sponsor's cash requirement. Work-in-kind is allowable when it: 1) provides value added, and/or 2) results in completing necessary work faster, cheaper, or better than the Corps of Engineers could alone or by contract. Work-in kind must be identified and documented clearly in the PMP before the work is begun. In-kind services must be in accordance with federal regulations, including OMB Circular A-87.

b. Work-in-kind must be performed by the Sponsor or by another non-federal partner under an approved third-party agreement with the Sponsor. All third-party agreements must be in accordance with the Feasibility Cost Sharing Agreement and be approved by the Corps of Engineers.

c. The process for claiming credit for in-kind services is:
   1) Negotiate the scope of services and associated costs between the Sponsor and the Corps,
   2) Sponsor performs the work and produces the required product,
   3) Sponsor documents the actual expenditures made to accomplish the work-in-kind,
   4) Corps verifies acceptability of the product relative to negotiated requirements,
   5) Corps credits the local Sponsor with an in-kind service credit.

d. Marsh Lake is integral to the Sponsors' Lac qui Parle Wildlife Management Area. Because the DNR is currently managing this resource, it is uniquely qualified to perform much of the analyses required in the study. This project management plan will not attempt to precisely scope or quantify every task to be completed as in-kind services. Rather, only those tasks that could reasonably be done by the Corps will be estimated in detail (such as topographic and archeological surveys). Cost estimates for other tasks that are less defined but clearly "add value" will be treated with great flexibility to allow for full collaboration during the study.

e. The value of in-kind services is estimated to be $234,000 from the Minnesota Department of Natural Resources as described in Paragraph 13—Scope of Work and the attached study cost estimate spreadsheets. (Note: as the study progresses, it is likely that additional in-kind services will be added via PDT recommendations and Executive Committee approval actions).

13. Scope of Work. The scope of work for each task and discipline is described in the attached study cost estimate spreadsheet. Major tasks and deliverables are described below and assigned to either the Corps or Minnesota DNR for primary responsibility:

a. Public Involvement:
   1) (DNR) Host, publicize and facilitate two public meetings:
      a. Public coordination meeting early in the study, and
      b. during the public review of the draft report, collect public input resulting from the meetings and provide written summaries for inclusion in study documents.
   2) (DNR) Maintain current project information for the public on the Internet, prepare newsletters, press releases, etc. as deemed appropriate throughout the study.
   3) (Corps) Participate at public meetings. Review and approve newsletters, press releases and proposed Internet content.

b. Institutional Studies:
   1) (Corps) Investigate project history, intergovernmental relations, and cost-sharing arrangements for implementing project recommendations

c. Social Studies:

1) (DNR) Conduct recreation needs analysis and justification for recreation features, possibly including a bike trail and bridge, boat ramps, and other amenities. Tasks may include:
   a. Compile Corps and MN DNR recreation visitation records over last 10 years
   b. Meet with Corps LQP project manager, recreation specialist to obtain data
   c. Compile MN DNR LQP State Park visitation data, creel survey data, etc.
   d. Forecast future recreational activity in the project area
2) (DNR) Write draft Feasibility report sections to document existing, future without-project, and future with-project recreation conditions. Provide documentation to support all recreation features included in the recommended plan.

d. Cultural Studies:

1) (Corps) Provide scope of work for cultural resources survey, and coordinate with SHPO
2) (DNR) Perform field archeology/cultural resources survey

e. Environmental Studies: Environmental design and NEPA process

1) (Corps) Prepare the Environmental Assessment and Section 404(b) evaluation
2) (Corps) Edit and finalize feasibility report sections, environmental appendix and management plan/operation manual
3) (Corps) Prepare GIS products for EA, displays for public meetings
4) (Corps) Obtain sediment testing for 404(b) evaluation & State Water Quality Certification
5) (Corps) Coordinate approval of planning models with Corps Planning Centers of Expertise
6) (Corps) Assist DNR in setting goals, objectives and constraints.
7) (Corps) Assist DNR in assessing existing conditions, developing operation plans and forecasting future conditions.
8) (DNR) Inventory existing conditions in Marsh Lake, Pomme de Terre River and Lac qui Parle, including all items noted in Attachment B, Workflow plan. Use existing information where possible, and collect any new information necessary to document conditions that is not included in other specific deliverables.
9) (DNR) Forecast fnture conditions withont project. Use professional judgment and approved models.
10) (DNR) Develop operating plans for proposed features/changes.
11) (DNR) Forecast future conditions with-project, define effects of proposed changes and assess project benefits/impacts. Use professional judgment and approved models.
12) (DNR) Write draft Feasibility report sections describing existing, future without-project and future with-project conditions and proposed operation plans.

f. Fish and Wildlife: (Corps) Fulfill Fish and Wildlife Coordination Act requirements

g. Economic Studies: (Corps) Cost effectiveness and incremental cost analysis of alternatives

h. Surveying and Mapping:

1) (DNR) Obtain field surveys including:
   a. Pomme de Terre cross sections: approximately 34 sections with soundings, avg. 1000 feet per section
   b. Embankment profile and sections:
      i. Complete road/embankment profile (9900 feet);
      ii. 99 cross sections, define embankment and areas within 100 feet npstream and downstream of embankment toes (upstream area is under water)
   c. Soundings and surveys near outlet structures

i. Complete topo mapping at existing structures and parking area
ii. Soundings above and below existing spillways: 10 foot grid within 100 feet upstream and 200 feet downstream of structures.

2) (DNR) Prepare mapping, digital terrain models, and cross sections for use in engineering design and GIS applications

i. Hydrology and Hydraulics:

1) (DNR) Lead the effort to refine problems and opportunities, project goals, objectives and constraints as described in Attachment B, Workflow plan. Conduct discussions and analyses necessary to finalize design parameters for features to be constructed.
2) (DNR) Participate in hydrologic design discussions and review Corps HMS modeling
3) (DNR) Participate in field inspections of the Pomme de Terre River existing and proposed channels
4) (DNR) Assist with designing fish passage structures: review Corps HEC-RAS
5) (Corps) Perform hydrologic and hydraulic analyses: Marsh Lake and Pomme de Terre hydrology (discharge duration, frequency analyses)
6) (Corps) Route historic hydrographs through Marsh Lake using a simple HMS model
7) (Corps) Produce stage duration relationships for different outlet weir configurations
8) (Corps) Desigu outlet weirs and other hydraulic features of outlet structures
9) (Corps) Design hydraulic features of Pomme de Terre re-alignment (diversion, bridge, new channel, scour protection, etc.)
10) (Corps) Determine Rosgen class of Pomme de Terre cross sections
11) (Corps) Conduct field inspections of Pomme de Terre geomorphology (existing and proposed channels)
12) (Corps) Design fish passage structures using HEC-RAS
13) (Corps) Design wave protection for the entire Marsh Lake Dam
14) (Corps) Prepare GIS information as needed to display hydrologic and hydraulic conditions
15) (Corps) Write hydraulics appendix for the feasibility report and pertinent portions of the main report and environmental assessment.

j. Foundations and Materials:

1) (Corps) Geotechnical design
2) Borings and testing
3) Stability issues at all structures and embankment
4) Review Periodic Inspection issues
5) Geotechnical appendix for report

k. Designs and Cost Estimates: (Corps) Structural and layout issues, construction cost estimates

l. Structnral designs

1) Primary outlet (modify or replace)
2) Variable-crest outlet/emergency spillway
3) Fish passage
4) Pomme de Terre re-alignment
1. Bridge
2. Diversion structure
5) Incorporate pedestrian/bike traffic across the project
6) Structural appendix to report
7) Modify abandoned fish rearing pond
8) Modify Lewisberg Road Culverts

m. Mechanical designs

1) Operable gates

n. General Engineering
   1) Drawings
      1. Site plans for structures
      2. Typical sections
      3. Pomme de Terre re-alignment layout
      4. Fish passage layont
   2) Quantities

o. Cost estimating
   1) Estimates for all alternatives (assume 4 alternatives)
   2) Appendix to report

p. Real Estate Stndies: (Corps and DNR) Assess real estate needs for project site, borrow and disposal areas

q. Study Management: (Corps and DNR) Administration, cost tracking, general coordination, Project Cooperation Agreement development

r. Plan Formulation: Developing, comparing and assessing alternatives
   1) (Corps) Assist in establishing problems/opportunities/goals/constraints
   2) (Corps) Assist in establishing fnture without-project condition
   3) (Corps) Lead alternative formulation and screening efforts
   4) (Corps) Conduct Milestone meetings: Feasibility scoping meeting, Alternative Formulation Briefing, and Civil Works Review Board (in Washington, DC)
   5) (Corps) Independent Technical Review
   6) (Corps) Valne Engineering study
   7) (DNR) Participate in Milestone meetings
   8) (DNR) Participate in a Value Engineering study

s. Report Preparation:
   1) (Corps) Future without-project analysis
   2) (Corps) Feasibility scoping meeting package
   3) (Corps) Alternatives analysis for AFB meeting
   4) (Corps) Draft report for public review and Civil Works Review Board
   5) (Corps) Final report
   6) (DNR) Review draft report before public review

14. Budget By Discipline: See Attachment C.

15. Deliverable and Prerequisite Schedule:

Activity ID	Activity Name	Duration (Days)	Start	Finish
Plan Formulation		2113.0d	02-May-07 A	27-Sep-13
FEA2420	Plan Formulation - Federal	670.0d	02-May-07 A	4-May-10
FEA2429	Feasibility Scoping Meeting	0.0d		11-Dec-07 A
FEA2430	AFB Project Doc	10.0d	05-May-10*	18-May-10
FEA2440	AFB Tech Review	19.0d	19-May-10	15-Jun-10
FEA2450	AFB Policy Compl	30.0d	19-May-10	30-Jun-10
FEA2460	Feas Alternative Formulation Briefing (AFB)	0.0d		19-Jul-10*
FEA2470	AFB Guid. Memo	10.0d	20-Jul-10	2-Aug-10
Feasibility Report		970.0d	23-Jul-07 A	18-Jul-11
FEA2480	Draft Feasibility Rpt/NEPA	38.0d	19-Aug-10	13-Oct-10
FEA2490	Conduct ITR	148.0d	23-Jul-07 A	11-Jan-08 A
FEA2492	Conduct ATR (Future)	90.0d	19-May-10	24-Sep-10
FEA2500	Submit Draft Feasibility Report	0.0d		13-Oct-10
FEA2505	HQ Policy Compliance Review	30.0d	14-Oct-10	26-Nov-10
FEA2570	Feas Review Conference (FRC)	0.0d		26-Nov-10
FEA2571	Feasibility Proj Guide Memo (PGM)	0.0d		26-Nov-10
FEA2575	Feasibility Public Review Period Start	0.0d	14-Oct-10	
FEA2577	Public Review Comments	30.0d	14-Oct-10	26-Nov-10
FEA2580	Prepare Final Report & Summary	19.0d	29-Nov-10	23-Dec-10
FEA2590	Issue Division Engineer's Transmittal Letter	0.0d		23-Dec-10
FEA2640	Washington Level Policy Review	19.0d	27-Dec-10	24-Jan-11
FEA2650	CWRB Briefing/Approval	0.0d		24-Jan-11
FEA2655	Prepare Draft Chief's Report	5.0d	25-Jan-11	31-Jan-11
FEA2657	State & Agency Review	48.0d	1-Feb-11	8-Apr-11
FEA2658	Feas State/Agency Review Complete	0.0d		8-Apr-11
FEA2660	Sign Feas Chief 's Report	0.0d		8-Apr-11
FEA2670	ASA(CW) Review	9.0d	11-Apr-11	21-Apr-11
FEA2700	ASA(CW) Memo to OMB	0.0d		21-Apr-11
FEA2709	OMB Review & Comment	60.0d	22-Apr-11	18-Jul-11
FEA2710	Feas Report to Congress	0.0d		18-Jul-11
Planning, Engineering & Design (PE&D)		161.0d	3-Oct-11	22-May-12
115058.300001.30AX0 PE&D Prog & Proj Mgmt		161.0d	3-Oct-11	22-May-12
A1400	Future FY planning - Fed	161.0d	03-Oct-11*	23-May-12
Construction		288.0d	1-Oct-12	22-Nov-13
115058.30D001.30DS0 Construction - Contract		288.0d	1-Oct-12	22-Nov-13

16. Statement of Approval: As of May 21, 2010, this PMP has been coordinated with the Project Delivery Team and has been adjusted based on resolution of comments received and is approved.

____
Michael Wyatt
Planner/Project Manager

ATTACHMENTS

A. Minnesota Department of Natural Resources "Agreement in Principle," executed June 12, 2003
B. Workflow Plan
C. Feasibility Study Cost Estimate
    a. Total Project Detail (2 pages)
    b. DNR Detail (2 pages)

ATTACHMENT A
MINNESOTA DNR "AGREEMENT IN PRINCIPLE"

ATTACHMENT A

Minnesota Department of Natural Resources

500 Lafayette Road
St. Paul, Minnesota 55155-40

July 11, 2003

Mr. Craig Evans, P.E.
U.S. Army Corps of Engineers
190 East Fifth Street
Saint Paul, Minnesota 55101-1638

Dear Mr. Evans:

This letter is to formally convey to the U.S. Army Corps of Engineers (USACE) the framework decision that has been agreed upon by the Minnesota Department of Natural Resources' (DNR) Divisions of Ecological Services, Fisheries, and Wildlife regarding the Marsh Lake Dam modification that will result in definite improvements to Marsh Lake's biological values. We are proposing that both the primary spillway and the emergency spillway be modified. We are also proposing that the Pomme de Terre River be restored to its pre-1938 channel. The attached Agreement in Principal outlines those proposed modifications. It also provides particular terms and constraints regarding the management of the facility.

There are several additional steps that the DNR needs to take, these include: communication with the public regarding our framework decision, development of a more detailed management plan, continue to evaluate other potentially interesting restoration strategies, and then determine and pursue the most appropriate means of funding for this project.

It has been our approach all along that once we can identify and agree upon the strategies that will have the greatest benefit for the resource and resource users, we will focus on financing and implementation. We recognize that the Marsh Lake dam is owned and managed by the USACE, and so we plan to work closely with the USACE to determine how best to pursue the funding and implementation. As a first step, the DNR would like to see the Marsh Lake dam modifications included in the Minnesota River Basin Reconnaissance study.

Sincerely,

TIMOTHY P. BREMICKER, Director
Division of Wildlife
DNR Building – 500 Lafayette Road
Saint Paul, Minnesota 55155-4007
(651) 297-4960

TPB/KV/jls; Attachment
c Bradley M. Moore, Assistant Commissioner for Operations
Ron Payer, Director, Division of Fisheries
Lee Pfannmuller, Director, Division of Ecological Services
Cheryl Heide, Regional Director, New Ulm

Agreement in Principle

Preamble

Marsh Lake is a 5,000 acre, shallow impoundment on the upper Minnesota River. It is located at the borders of Big Stone, Lac qui Parle and Swift Counties. Because of the nature of the existing fixed crest the basin is not subject to the dynamic variation in water levels that healthy wetland systems require. This facility is part of the US Army Corps of Engineers Lac qui Parle Flood Control Project. However, its origins predate the flood control project as a WPA water conservation project. The USACE has notified the Department of Natural Resources that the facility provides no flood control benefit. The USACE has requested the Minnesota DNR recommend appropriate modifications to the facility in order to enhance ecological and recreational values of the basin and the Minnesota River. A work group of six DNR staff have been working on developing a set of recommendations to the USACE since January 2001. This framework carefully balances a number of potentially competing natural resource and recreational values associated with Marsh Lake and the Minnesota River. We, the undersigned Senior Managers, agree in principle to the below described framework to improve and enhance Marsh Lake.

Modifications to the Marsh Lake Dam

The Marsh Lake Dam is an earthen berm 11,800 feet long, with a primary spillway 112 feet wide set at a run out elevation of 937.6 feet. It also has a 90 foot wide emergency spillway with a run out elevation of 940 feet. The DNR would propose to the USACE the following modifications to the Marsh Lake Dam.

Primary Outlet: The primary spillway would be modified to maintain a water surface elevation of 938.3 feet or higher 70% of the time in August, and 937.6 feet or higher 70% of the time in September and October, excluding years in which a draw down is completed. A design, based on returning the Pomme de Terre River to its 1938 channel, would incorporate both a low flow notch cut into the spillway and a narrowing of the spillway above the current run out elevation. The low flow notch would be approximately 2 feet wide with a bottom elevation of 935.5 feet. In addition, the spillway would be narrowed from 112 feet to approximately 30 feet between the elevations of 937.6 to 938.3. The spillway would then widen back out to 112 feet above the 938.3 feet elevation. A fish passage structure consisting of rock riffles would also be constructed at the outlet.

Emergency Spillway: The emergency spillway would be replaced with a variable crest structure. The structure's final dimensions will be set to pass a May Q70 flow at a draw down elevation of 936. A fish passage structure consisting of rock riffles would also be constructed at this outlet. The structure will continue to function as an emergency spillway at water surface elevations above 940 feet.

Pomme de Terre River: The Pomme de Terre River will be restored to its 1938 Channel and flood plain. As a result, the Pomme de Terre will flow directly into the Minnesota River/Lac qui

Parle Lake downstream of the Marsh Lake dam. During some flood events, a portion of the Pomme de Terre's flow may spill over into Marsh Lake.

Management Plan

The above modifications are contingent upon a management plan being developed that includes the following core points.

- The maximum targeted drawdown will be to an elevation of 936.
- Clear triggers and constraints will be established that govern when a draw down will be attempted including: vegetation, sufficient year classes of northern pike present, and sufficiently small snow pack to predict a reasonable probability of success.
- When active drawdowns are conducted, the basin will remain in drawdown condition through the fall and winter. Refill will be accomplished during spring floods. However, refill or partial refill in the fall could be accomplished if precipitation results in a spike in the Minnesota River's flow, such that a "normal" discharge hydrograph can be maintained while raising pool levels.
- Consecutive attempts at drawdowns over a multiple year period will not be made.
- Fish passage will be available at one or both of the outlets 100% of the time.
- A monitoring program will be developed which includes: vegetation, fish populations, waterfowl populations, and flows.
- In the event of unanticipated water levels or vegetative responses, appropriate modifications could be made to the primary spillway or the management plan.

Agreement

While additional detailed management plans and construction designs will needed to be developed, we agree in principal to the above described framework for modifying and managing the Marsh Lake Dam

Tim Bremicker 6/12/2003
Tim Bremicker, Director Date
Division of Wildlife

Ronald D. Payer 6/12/03
Ron Payer, Director Date
Division of Fisheries

Cheryl Heide 6/11/03
Cheryl Heide, Regional Director Date
Southern Region

Lee A. Pfannmuller 6/12/03
Lee Pfannmuller, Director Date
Division of Ecological Services

ATTACHMENT B
WORKFLOW PLAN

The following outline describes the general workflow expected for the study. Bullets indicate the types of information that will be needed and questions that will be asked. These planning steps are iterative, so the actual order of task completion will evolve with the study and will depend on funding and staff availability over the life of the study.

1. Gather all existing planning documentation from prior MN DNR efforts

- Meeting notes
- Preliminary plans
- Public comments

2. Specify problems and opportunities: This task will be a refinement of the work that led to the Agreement in Principle. It will involve group discussion and integratiou of data from the inventory of existing conditions.

- State problems and opportunities (See Agreement in Principle)
- Determine project goals (what are we shooting for?)
    - Target species (fish, pelicans, waterfowl, other?)
    - Habitat types to be developed and maintained
    - Water quality standards
        - (seasonally different?—i.e. is winterkill desirable?)
- Determine project objectives and constraints (what changes are needed to meet the goals? What do we need to avoid?)
    - Desirable water levels, fluctuation and timing
        - Normal operations
        - During a drawdown
        - How low is too low?
        - *How will we determine these? What models are needed to predict outcomes of specific measures?*
    - Fish passage—define parameters
        - When do fish need to pass?
        - Access to spawning areas in PdT and Marsh Lake with various measures
    - Water quality—nutrient balance, determine what actions can we really control?
    - Recreation needs
        - Access to the lake(s)
        - Pomme de Terre canoeing?
        - Future bike trail?

3. Hold a NEPA scoping meeting

- Make sure the public has input into the current study process and can identify any special concerns to be addressed. (Do this as soon as we have sufficient Federal funding.)

4. Inventory existing conditions

- Water quality
    - Marsh Lake
    - Pomme de Terre
    - Lac qui Parle
        - DO
        - N, P
        - Chlorophyll A, algal density
        - Suspended solids
- Fish & mussel populations (in all three water bodies)
    - Mussel survey
    - Assemble existing fish survey iufo
- Macro-invertebrates

- Wildlife populations (waterfowl, pelicans, uplands)
- Rare and endangered species
- Aquatic vegetation (submersed, emergent, and algal)
- Land use/land cover in study area
- Bathymetry (provide most recent data available)
- Assess Pomme de Terre channel (i.e. Rosgen, existing and old alignment)
- Sediment budgets—Marsh Lake and Lac qui Parle
- Recreational usage, hunting, birding, fishing, access for all, biking, canoeing
- Safety history
- Obtain topographic surveys, cross sections, soundings, etc.
- Cultural resources
- Real estate needs
- Hydrologic records
- Sediment sampling and testing for dredging disposal/permitting
- Corps and State authorities and responsibilities

5. Forecast future conditions in all three water bodies <u>without</u> the project
- Water quality
- Water levels and fluctuations—impacts of upstream reservoirs, i.e. Bigstone
- Fish and mussel populations
- Wildlife populations
- Aquatic vegetation
- Sedimentation
- Recreation

6. Preliminary plan formulation: Formulate alternative plans
- Define <u>measures</u> to achieve objectives
  - Re-assess details of the Agreement in Principle
  - Value Engineering study to identify possible enhancements or additional measures
- Hydrologic and Hydraulic design of structures to achieve target water levels
- Preliminary ITR to check future without project conditions analyses and preliminary H&H

<u>7. Hold a Feasibility Scoping Meeting (FSM) with vertical team</u>

8. Advanced plan formulation: Formulate alternative plans
- Preliminary design and refining of measures (mostly engineering tasks with guidance from all)
  - Pomme de Terre realignment
    - Diversion structure
    - Bridge or structure to cross roadway
    - Determine new alignment
  - Variable crest structure
  - Fixed crest structure (elliptical profile)
  - Fish passage structures
  - Provide bike crossing capability
  - Earth dam issues
  - Other (Islands, recreation features)
- Geotechnical borings and analyses
- Structural design
- Cost estimating
- Prepare operating plans

9. Evaluate effects of alternative plans
- Describe future conditions with project in place (mostly environmental discussion—includes obtaining sufficient data and modeling to document assumptions)

10. Compare alternative plans
- Prepare a matrix (use IWR Plan software) to conduct cost-effectiveness and incremental cost analyses

11. Select Tentatively Recommended plan
- Prepare AFB documentation package/draft report
- Independent Technical Review
- Study team review

12. Hold Alternative Formulation Briefing (AFB) with Corps vertical team
- Either by telephone or on site

13. Final plan formulation and design details for recommended plan
- Develop detail sufficient for baseline cost estimate (engineering tasks)
- Prepare plates and design calculations for engineering appendixes

14. Prepare final draft report
- Finalize draft report
- Study team review
- Independent Technical Review
- Incorporate comments

15. Public review of final draft report per MEPA and NEPA
- 30-day review period
- Hold a Pnblic meeting
- Incorporate comments/address issues/finalize MEPA
- Sign FONSI (unless EIS is required)
- Final ITR signoff (to verify acceptability of final changes)

16. Submit draft report to MVD and HQUSACE for policy review

17. Conduct Civil Works Review Board briefing
- Key study team members travel to Washington, D.C.

18. Prepare Chief of Engineers' report
19. NEPA State and Agency review of Chief's report
20. HQUSACE submit signed Chief's report to ASA(CW)
21. ASA(CW) sign Record of Decision and submit signed Chief's report to OMB
22. OMB review and submit ROD and Chief's report to Congress

ATTACHMENT C
ESTIMATED STUDY COSTS

Marsh Lake Aquatic Ecosystem Restoration
Feasibility Study Cost Estimate
August 2009

Total Project Detail

	Task Description	Estimated Cost ($ Thousands) Corps	In-kind*	Study Total	Notes:	Thru 06/09 Estimates	FY 2009 4 Qtr Jul-Sep	FED FY 2010 1 Qtr Oct-Dec	2 Qtr Jan-Mar	3 Qtr Apr-Jun	4 Qtr Jul-Sep	FY 2011 1 Qtr Oct-Dec	Total
A	**Public Involvement**	0	9	9	Public meetings, newsletters, etc.	0							
	Public Meetings (arrange and facilitate)		4		Assume 2 meetings: scoping and draft review	0			0		4		$4
	Prepare record of comments		2			0			0		2		$2
	News releases and Newsletters		3			0			0		2		$3
	Corps participation at meetings	0	0		Assume included in numbers below	0					0		$0
			0			0							
B	**Institutional Studies**	5	0	5	Project history, intergovernmental relations. Determine appropriate program/cost-sharing policy.	3			2				$5
			0			0							
C	**Social Studies**		7	7	Recreation, etc.	0							
	Conduct recreation needs analyses		5			5							$5
	Draft report sections for recreation		2			2							$2
			0			0							
D	**Cultural Studies**	5	16	21	Cultural resources survey, coordination	0							
	Corps admin and report writing	5	0		Admin, analysis, coordination with SHPO	2	0	3					$5
	Field surveys		16		To be done by DNR staff archaeologists	0	16						$16
			0			0							
			0			0							
E	**Environmental Studies**	97	52	149	Environmental design and NEPA process	0							
	GIS products for EA	6	4			0	6						$10
	Write EA, Feas report, ops plan & appendix	55	0			17	10	10	6	3	6	3	$55
	Coordination & meetings	16	0			8			2	2	2	2	$16
	Sediment testing	20	0		Contracted	0		20					$20
	(DNR) Inventory existing conditions		20		Gather existing info, collect data if needed	20							$20
	(DNR) Forecast future with- and without-project		18		DNR lead team discussion and modeling	8					10		$18
	(DNR) Write draft report sections		10		Describe existing, future-without and future with-project conditions for Feasibility report	10							$10
			0			0							
			0			0							
F	**Fish and Wildlife**	5	0	5	Coordination Act Requirements W/FWS	0	5						$5
			0			0							
G	**Economic Studies**	15	0	15	Recreation benefits, economic justification, incremental cost analysis	3	2	2	2	2	2	2	$15
			0			0							
H	**Surveying and Mapping**	5	20	25	Topography, cross sections, soundings	0							
	Coordination and admin		3			3							$3
	Pomme de Terre River cross sections		4		Most done December 2006. Re-do portions originally out of tolerance.	4							$4
	Embankment cross sections		0		Done December 2006	0							$0
	Outlet structures and site topography		0		Done December 2006	0							$0
	Soundings/bathymetry near outlet		3		Most done Dec 2006 except u.s. soundings	3							$3
	Reducing/plotting/mapping		10		Office caculations	10							$10
	Corps coordination	5	0			5							$5
			0			0							
J	**Hydrology and Hydraulics**	84	42	126	Hydraulic design of channel and dam mods	0							
	(Corps) Hydrology	12	2		Marsh lake and PdT discharge/duration history	7							$14
	(Corps) Terre RAS modeling of PDT, Marsh Lk, LQP	30	2		Existing and proposed conditions	8							$32
	(Corps) Pomme de Terre Geomorphology	6	2		Rosgen classification, field inspections	6							$8
	(Corps) Fish Passage (1-D modeling)	0	2			0	0						$2
	(Corps) Scour protection	9	2		Wave protection and stream erosion protection	0							$11
	(Corps) Feasibility appendix, coord & GIS	27	2			2	2	2			6	6	$29
	(DNR) Determine goals, objectives, constraints		6		DNR lead team discussion	5							$6
	(DNR) Hydrology		5		DNR participate and review	0	2						$5
	(DNR) Pomme de Terre Geomorphology		4		DNR field inspections with Corps	2							$4
	(DNR) Fish Passage		3		DNR assist design, review models	0	0						$3
	(DNR) Develop operation plans for alternatives		11		DNR lead team discussion and modeling	4							$11
	(DNR) Review H&H appendix		1			0			1				$1
						0							
						0							
						0							
						0							
K	**Foundations and Materials**	138	3	141	Geotechnical design	0							
	Review existing data	6	1			0	6						$7

	Borings and testing	60	1		Contracted	0	0						$61
	Assess stability/ geotechnical design	60	1			0	0			27	13		$61
	Feasibility report appendix	12	0			0			0		12		$12
			0			0							
M	**Designs and Cost Estimates**	181	20	201	Structural and layout issues, construction cost estimates	0							
			0			0							$0
	Structural design		0		All designs to feasibility level of detail.	0							$0
	PdT diversion and road bridge	8	2			0	6						$10
	Emergency spillway new operable structure	12	2			0	3	3					$14
	Existing spillway modifications	5	2			0	2	2					$7
	Pedestrian/bike bridge	6	1		To accommodate future bike trail	0	2	2					$7
	Feasibility appendix and coord	18	2			0	5	2					$20
	Fish Passage	0	3			0							$3
	Fish Pond Mods (Inlet and Outlet)	0	1			0							$1
	Lewisberg Road Culverts	0	3			0							$3
			0			0							$0
	Mechanical design	6	0			0	2	3	1				$6
			0			0							$0
	General engineering/layout		0			0							$0
	Site plans, typical sections, layout	84	2			7	15	23			4	2	$86
	Quantity calculations	12	2			0		4					$14
			0			0							
	Cost estimates	30	0		Establish alternative costs and final baseline cost for authorization	0	12	6	6	3	1	2	$30
			0			0							
N	**Real Estate Studies**	10	3	13	Project site, borrow and disposal areas	0							
	Corps staff activities	10	0		Real Estate Plan and appraisals	0	7		2	1			$10
	DNR staff activities		3		Assist with local knowledge	0	3						$3
			0			0							
P	**Study Management**	92	16	108	Administration, cost tracking, coordination	0							
	General coordination	52	0		Includes Executive Committee time	22	5	5	5	5	5	5	$52
	Study funds control	38	0			14	4	4	4	4	4	4	$38
	Project Cooperation Agreement for construction	2	0			0					2		$2
	DNR in-kind for study management		16		Includes Executive Committee time	3							$16
			0			0							
Q	**Plan Formulation**	74	13	87	Developing and assessing alternatives, milestone meetings, ITR review	0							
	Corps PM guide early planning tasks	2	0			2							$2
	Preliminary formulation & screening	2	0			2							$2
	Feasibility Scoping Meeting	2	0			2							$2
	Alternative Formulation Briefing	6	0			0				6			$6
	CWRB meeting (in Washington, D.C.)	12	0			0					3	9	$12
	Independent Technical Review (ongoing) & VE	50	0		Performed by another MVD District	15				24	11		$50
	Value Engineering Study (in-kind participation)		6		Assume 3 people for 3 days	3						3	$6
	DNR in-kind attendance at milestone meetings		7		Feasibility Scoping Meeting, AFB & CWRB	1				3		3	$7
			0			0							
R	**Report Reviews**	52	16	68	Prepare draft and final reports of findings	0							
	Without-project analysis	5	0			5							$5
	Feasibility scoping meeting documents	8	0			8							$8
	Alternative analysis for AFB meeting	21	0			5	5	5	6				$21
	Draft report for public review & CWRB	12	0			0				6	6		$12
	(DNR) review draft reports		16		Assume 2 rounds of review	0							$13
	Final report	6	0			0							$9
			0			0							$0
S	**Expenses**		17	17	Project expenses related to travel, fleet, etc.	0							$17
	Column Totals	763	234	997	Quarterly Subtotals	226	125	219	136	133	102	56	$997
	CADD	54		54	CADD	2	11	10	14	12			$54
	Miscellaneous & Contingency	21		21	Miscellaneous & Contingency	0	0	1	3	3	5	6	$21
					Quarterly Subtotals	231	136	230	153	148	112	62	$1,072
	TOTAL	$838	$234	$1,072									
					Cumulative Subtotals		$367	$597	$750	$898	$1,010	$1,072	

FUNDING SUMMARY			$1,072,000	Total
Federal Funds	$536,000		$536,000	
Non-federal In-kind Services		$234,000	$234,000	
Non-federal Cash	$302,000		$302,000	

* In-kind data comes from the "DNR Detail" spreadsheet.

Assumptions:

1. Two year study (with optimal funding)
2. DNR in-kind estimate based on aggregated average daily cost of $650 per day. Actual value for in-kind credit will be based on official DNR accounting.

Marsh Lake Aquatic Ecosystem Restoration
Feasibility Study Cost Estimate
August 2009

DNR Detail

$650 Estimated DNR daily cost

			DNR $ Costs**		DNR		Estimated Person-days					
	Task Description	Corps***	Distributed	Cost	DAYS*	Notes:	Wildlife	Fisheries	Eco	L&M/Eng	Waters	Regional Admin
A	**Public Involvement**		$9	$9	14	Public meetings, newsletters, etc.	4	2	2		2	4
	Public Meetings (arrange and facilitate)		$4			Assume 2 meetings: scoping and draft review						
	Prepare record of comments		$2			0						
	News releases and Newsletters		$3			0						
	Corps participation at meetings					Assume included in numbers below						
						0						
B	**Institutional Studies**	$5		$0	0	Project history, intergovernmental relations. Determine appropriate program/cost-sharing policy.						
						0						
C	**Social Studies**		$7	$7	10	Recreation, etc.	7	2	1			
	Conduct recreation needs analyses		$5			0						
	Draft report sections for recreation		$2			0						
						0						
D	**Cultural Studies**	$5	$16	$16	25	Cultural resources survey, coordination						25
	Corps admin and report writing	$5				Admin, analysis, coordination with SHPO						
	Field surveys		$16			To be done by DNR staff archaeologists						
						0						
						0						
E	**Environmental Studies**	$97	$52	$52	80	Environmental design and NEPA process	20	6	54			
	GIS products for EA	$6	$4			0						
	Write EA, Feas report, ops plan & appendix	$55				0						
	Coordination & meetings	$16				0						
	Sediment testing	$20				Contracted						
	(DNR) Inventory existing conditions		$20			Gather existing info, collect data if needed						
	(DNR) Forecast future with- and without-project		$18			DNR lead team discussion and modeling						
	(DNR) Write draft report sections		$10			Describe existing, future-without and future with-project conditions for Feasibility report						
						0						
						0						
F	**Fish and Wildlife**	$5		$0	0	Coordination Act Requirements W/FWS						
						0						
G	**Economic Studies**	$15		$0	0	Recreation benefits, economic justification, incremental cost analysis						
						0						
H	**Surveying and Mapping**	$5	$20	$20	31	Topography, cross sections, soundings	1	2		28		
	Coordination and admin		$3			0						
	Pomme de Terre River cross sections		$4			Most done December 2006. Re-do portions originally out of tolerance.						
	Embankment cross sections					Done December 2006						
	Outlet structures and site topography					Done December 2006						
	Soundings/bathymetry near outlet		$3			Most done Dec 2006 except u.s. soundings						
	Reducing/plotting/mapping		$10			Office caculations						
	Corps coordination	$5				0						
						0						
J	**Hydrology and Hydraulics**	$84	$42	$42	65	Hydraulic design of channel and dam mods	17	17	20	4	7	
	(Corps) Hydrology	$12	$2			Marsh lake and PdT discharge/duration history						
	(Corps) Pomme de Terre RAS modeling	$30	$2			Existing and proposed conditions						
	(Corps) Pomme de Terre Geomorphology	$6	$2			Rosgen classification, field inspections						
	(Corps) Fish Passage (1-D modeling)		$2			0						
	(Corps) Scour protection	$9	$2			Wave protection and stream erosion protection						
	(Corps) Feasibility appendix, coord & GIS	$27	$2			0						
	(DNR) Determine goals, objectives, constraints		$6			DNR lead team discussion						
	(DNR) Hydrology		$5			DNR participate and review						
	(DNR) Pomme de Terre Geomorphology		$4			DNR field inspections with Corps						
	(DNR) Fish Passage		$3			DNR assist design, review models						
	(DNR) Develop operation plans for alternatives		$11			DNR lead team discussion and modeling						

	(DNR) Review H&H appendix		$1				0						
							0						
K	**Foundations and Materials**	$138	$3	$3	4	Geotechnical design		1	1	1	1		
	Review existing data	$6	$1				0						
	Borings and testing	$60	$1			Contracted							
	Assess stability/ geotechnical design	$60	$1				0						
	Feasibility report appendix	$12					0						
							0						
M	**Designs and Cost Estimates**	$181	$20	$20	30	Structural and layout issues, construction cost estimates		9	9	6	4	2	
							0						
	Structural design					All designs to feasibility level of detail.							
	PdT diversion and road bridge	$8	$2				0						
	Emergency spillway new operable structure	$12	$2				0						
	Existing spillway modifications	$5	$2				0						
	Pedestrian/bike bridge	$6	$1			To accommodate future bike trail							
	Feasibility appendix and coord	$18	$2				0						
	Fishways		$3										
	Fish Pond Mods (Inlet and Outlet)		$1										
	Lewisberg Road Culverts		$3										
							0						
	Mechanical design	$6					0						
							0						
	General engineering/layout						0						
	Site plans, typical sections, layout	$84	$2				0						
	Quantity calculations	$12	$2				0						
							0						
	Cost estimates	$30				Establish alternative costs and final baseline cost for authorization							
							0						
N	**Real Estate Studies**	$10	$3	$3	5	Project site, borrow and disposal areas		2	1	1	1		
	Corps staff activities	$10				Real Estate Plan and appraisals							
	DNR staff activities		$3			Assist with local knowledge							
							0						
P	**Study Management**	$92	$16	$16	25	Administration, cost tracking, coordination		14	4	4	1	1	1
	General coordination	$52				Includes Executive Committee time							
	Study funds control	$38					0						
	Project Cooperation Agreement for construction	$2					0						
	DNR in-kind for study management		$16			Includes Executive Committee time							
							0						
Q	**Plan Formulation**	$74	$13	$13	20	Developing and assessing alternatives, milestone meetings, ITR review		5	5	5	2	2	1
	Corps PM guide early planning tasks	$2					0						
	Preliminary formulation & screening	$2					0						
	Feasibility Scoping Meeting	$2					0						
	Alternative Formulation Briefing	$6					0						
	CWRB meeting (in Washington, D.C.)	$12					0						
	Independent Technical Review (ongoing) & VE	$50				Performed by another MVD District							
	Value Engineering Study (in-kind participation)		$6			Assume 3 people for 3 days							
	DNR in-kind attendance at milestone meetings		$7			Feasibility Scoping Meeting, AFB & CWRB							
							0						
R	**Report Preparation**	$52	$16	$16	25	Prepare draft and final reports of findings		5	5	5	5	5	
	Without-project analysis	$5					0						
	Feasibility scoping meeting documents	$8					0						
	Alternative analysis for AFB meeting	$21					0						
	Draft report for public review & CWRB	$12					0						
	(DNR) review draft reports		$16			Assume 2 rounds of review							
	Final report	$6					0						
							0						
S	Expenses		$17	$17		Project expenses related to travel, fleet, etc.							
	Column Totals	$763	$234	$234	334	(Actual estimated person-days)		85	54	99	46	19	31
					360.0	(Re-calculated person-days after rounding $)							

* DNR DAYS column contains the DNR's estimated man-days

** Estimated cost ($Thousands) is calculated based on DNR's estimated man-day cost and distributed to tasks by Corps' PM.

*** Data in the "Corps" column comes from the "Corps Detail" spreadsheet

Appendix B – Feasibility Cost-Share Agreement

AGREEMENT
BETWEEN THE DEPARTMENT OF THE ARMY
AND
THE MINNESOTA DEPARTMENT OF NATURAL RESOURCES
FOR THE
MARSH LAKE AQUATIC ECOSYSTEM RESTORATION FEASIBILITY STUDY

THIS AGREEMENT is entered into this 2nd day, of May, 2007, by and between the Department of the Army (hereinafter the "Government"), represented by the District Engineer executing this Agreement, and the Minnesota Department of Natural Resources (hereinafter the "Sponsor"),

WITNESSETH, that

WHEREAS, the Congress (Senate and/or House Committees) has requested the Board of Engineers for Rivers and Harbors to conduct a study of "the advisability of further improvements in the Minnesota River Basin for navigation, flood control, recreation, low flow augmentation, and other related land and water resources" pursuant to a May 10, 1962 resolution of the House Committee on Public Works; and

WHEREAS, the U.S. Army Corps of Engineers has conducted a reconnaissance study of the Minnesota River Basin pursuant to this authority, and has determined that further study in the nature of a "Feasibility Phase Study" (hereinafter the "Study") is required to fulfill the intent of the study authority and to assess the extent of the Federal interest in participating in a solution to the identified problem; and

WHEREAS, Section 105 of the Water Resources Development Act of 1986 (Public Law 99-662, as amended) specifies the cost sharing requirements applicable to the Study;

WHEREAS, the Sponsor has the authority and capability to furnish the cooperation hereinafter set forth and is willing to participate in study cost sharing and financing in accordance with the terms of this Agreement; and

WHEREAS, the Sponsor and the Government understand that entering into this Agreement in no way obligates either party to implement a project and that whether the Government supports a project authorization and budgets it for implementation depends upon, among other things, the outcome of the Study and whether the proposed solution is consistent with the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies and with the budget priorities of the Administration;

NOW THEREFORE, the parties agree as follows:

ARTICLE I - DEFINITIONS

For the purposes of this Agreement:

A. The term "Study Costs" shall mean all disbursements by the Government pursuant to this Agreement, from Federal appropriations or from funds made available to the Government by the Sponsor, and all negotiated costs of work performed by the Sponsor pursuant to this Agreement. Study Costs shall include, but not be limited to: labor charges; direct costs; overhead expenses; supervision and administration costs; the costs of participation in Study Management and Coordination in accordance with Article IV of this Agreement; the costs of contracts with third parties, including termination or suspension charges; and any termination or suspension costs (ordinarily defined as those costs necessary to terminate ongoing contracts or obligations and to properly safeguard the work already accomplished) associated with this Agreement.

B. The term "estimated Study Costs" shall mean the estimated cost of performing the Study as of the effective date of this Agreement, as specified in Article III.A. of this Agreement.

C. The term "excess Study Costs" shall mean Study Costs that exceed the estimated Study Costs and that do not result from mutual agreement of the parties, a change in Federal law that increases the cost of the Study, or a change in the scope of the Study requested by the Sponsor.

D. The term "study period" shall mean the time period for conducting the Study, commencing with the release to the U.S. Army Corps of Engineers St. Paul District of initial Federal feasibility funds following the execution of this Agreement and ending when the Assistant Secretary of the Army (Civil Works) submits the feasibility report to the Office of Management and Budget (OMB) for review for consistency with the policies and programs of the President.

E. The term "PSP" shall mean the Project Study Plan, which is attached to this Agreement and which shall not be considered binding on either party and is subject to change by the Government, in consultation with the Sponsor.

F. The term "negotiated costs" shall mean the costs of in-kind services to be provided by the Sponsor in accordance with the PSP.

G. The term "fiscal year" shall mean one fiscal year of the Government. The Government fiscal year begins on October 1 and ends on September 30.

ARTICLE II - OBLIGATIONS OF PARTIES

A. The Government, using funds and in-kind services provided by the Sponsor and funds appropriated by the Congress of the United States, shall expeditiously prosecute and complete the Study, in accordance with the provisions of this Agreement and Federal laws, regulations, and policies.

B. In accordance with this Article and Article III.A., III.B. and III.C. of this Agreement, the Sponsor shall contribute cash and in-kind services equal to fifty (50) percent of Study Costs other than excess Study Costs. The Sponsor may, consistent with applicable law and regulations, contribute up to 50 percent of Study Costs through the provision of in-kind services. The in-kind services to be provided by the Sponsor, the estimated negotiated costs for those services, and the estimated schedule under which those services are to be provided are specified in the PSP. Negotiated costs shall be subject to an audit by the Government to determine reasonableness, allocability, and allowability.

C. The Sponsor shall pay a fifty (50) percent share of excess Study Costs in accordance with Article III.D. of this Agreement.

D. The Sponsor understands that the schedule of work may require the Sponsor to provide cash or in-kind services at a rate that may result in the Sponsor temporarily diverging from the obligations concerning cash and in-kind services specified in paragraph B. of this Article. Such temporary divergences shall be identified in the quarterly reports provided for in Article III.A. of this Agreement and shall not alter the obligations concerning costs and services specified in paragraph B. of this Article or the obligations concerning payment specified in Article III of this Agreement.

E. If, upon the award of any contract or the performance of any in-house work for the Study by the Government or the Sponsor, cumulative financial obligations of the Government and the Sponsor would result in excess Study Costs, the Government and the Sponsor agree to defer award of that and all subsequent contracts, and performance of that and all subsequent in-house work, for the Study until the Government and the Sponsor agree to proceed. Should the Government and the sponsor require time to arrive at a decision, the Agreement will be suspended in accordance with Article X., for a period of not to exceed six months. In the event the Government and the sponsor have not reached an agreement to proceed by the end of their 6 month period, the Agreement may be subject to termination in accordance with Article X.

F. No Federal funds may be used to meet the Sponsor's share of Study Costs unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized by statute.

G. The award and management of any contract with a third party in furtherance of this Agreement which obligates Federal appropriations shall be exclusively within the control of the Government. The award and management of any contract by the Sponsor with a third party in furtherance of this Agreement which obligates funds of the Sponsor and does not obligate Federal appropriations shall be exclusively within the control of the Sponsor, but shall be subject to applicable Federal laws and regulations.

ARTICLE III - METHOD OF PAYMENT

A. The Government shall maintain current records of contributions provided by the parties, current projections of Study Costs, current projections of each party's share of Study Costs, and current projections of the amount of Study Costs that will result in excess Study Costs. At least quarterly, the Government shall provide the Sponsor a report setting forth this information. As of the effective date of this Agreement, estimated Study Costs are $900,000 and the Sponsor's share of estimated Study Costs is $450,000. In order to meet the Sponsor's cash payment requirements for its share of estimated Study Costs, the Sponsor must provide a cash contribution currently estimated to be $302,000. The dollar amounts set forth in this Article are based upon the Government's best estimates, which reflect the scope of the study described in the PSP, projected costs, price-level changes, and anticipated inflation. Such cost estimates are subject to adjustment by the Government and are not to be construed as the total financial responsibilities of the Government and the Sponsor.

B. The Sponsor shall provide its cash contribution required under Article II.B. of this Agreement in accordance with the following provisions:

1. For purposes of budget planning, the Government shall notify the Sponsor by March 30 of each year of the estimated funds that will be required from the Sponsor to meet the Sponsor's share of Study Costs for the upcoming fiscal year.

2. No later than 30 calendar days prior to the scheduled date for the Government's issuance of the solicitation for the first contract for the Study or for the Government's anticipated first significant in-house expenditure for the Study, the Government shall notify the Sponsor in writing of the funds the Government determines to be required from the Sponsor to meet its required share of Study Costs for the first fiscal year of the Study. No later than 15 calendar days thereafter, the Sponsor shall provide the Government with the full amount of such required funds by delivering a check payable to "FAO, USAED, ST. PAUL DISTRICT (B6)" to the District Engineer, or verifying to the satisfaction of the Government that the Non-Federal Sponsor has deposited such required funds in an escrow or other account acceptable to the Government, with interest accruing to the Non-Federal Sponsor, or by presenting the Government with an irrevocable letter of credit acceptable to the Government for such required funds, or by providing an Electronic Funds Transfer of such required funds in accordance with procedures established by the Government.

3. For the second and subsequent fiscal years of the Study, the Government shall, no later than 60 calendar days prior to the beginning of the fiscal year, notify the Sponsor in writing of the funds the Government determines to be required from the Sponsor to meet its required share of Study Costs for that fiscal year, taking into account any temporary divergences identified under Article II.D of this Agreement. No later than 30 calendar days prior to the beginning of the fiscal year, the Sponsor shall make the full amount of the required funds available to the Government through the funding mechanism specified in paragraph B.2. of this Article.

4. The Government shall draw from the funds provided by the Sponsor such sums as the Government deems necessary to cover the Sponsor's share of contractual and in-house fiscal obligations attributable to the Study as they are incurred.

5. In the event the Government determines that the Sponsor must provide additional funds to meet its share of Study Costs, the Government shall so notify the Sponsor in writing. No later than 60 calendar days after receipt of such notice, the Sponsor shall make the full amount of the additional required funds available through the funding mechanism specified in paragraph B.2. of this Article.

C. Within ninety (90) days after the conclusion of the Study Period or termination of this Agreement, the Government shall conduct a final accounting of Study Costs, including disbursements by the Government of Federal funds, cash contributions by the Sponsor, the amount of any excess Study Costs, and credits for the negotiated costs of the Sponsor, and shall furnish the Sponsor with the results of this accounting. Within thirty (30) days thereafter, the Government, subject to the availability of funds, shall reimburse the Sponsor for the excess, if any, of cash contributions and credits given over its required share of Study Costs, other than excess Study Costs, or the Sponsor shall provide the Government any cash contributions required for the Sponsor to meet its required share of Study Costs other than excess Study Costs.

D. The Sponsor shall provide its cash contribution for excess Study Costs as required under Article II.C. of this Agreement by delivering a check payable to "FAO, USAED, ST. PAUL DISTRICT (B6)" to the District Engineer as follows:

1. After the project that is the subject of this Study has been authorized for construction, no later than the date on which a Project Cooperation Agreement is entered into for the project; or

2. In the event the project that is the subject of this Study is not authorized for construction by a date that is no later than 5 years of the date of the final report of the Chief of Engineers concerning the project, or by a date that is no later than 2 years after the date of the termination of the study, the Sponsor shall pay its share of excess costs on that date (5 years after the date of the Chief of Engineers or 2 year after the date of the termination of the study).

ARTICLE IV - STUDY MANAGEMENT AND COORDINATION

A. To provide for consistent and effective communication, the Sponsor and the Government shall appoint named senior representatives to an Executive Committee. Thereafter, the Executive Committee shall meet regularly until the end of the Study Period.

B. Until the end of the Study Period, the Executive Committee shall generally oversee the Study consistently with the PSP.

C. The Executive Committee may make recommendations that it deems warranted to the District Engineer on matters that it oversees, including suggestions to avoid potential sources of dispute. The Government in good faith shall consider such recommendations. The Government has the discretion to accept, reject, or modify the Executive Committee's recommendations.

D. The Executive Committee shall appoint representatives to serve on a Study Management Team. The Study Management Team shall keep the Executive Committee informed of the progress of the Study and of significant pending issues and actions, and shall prepare periodic reports on the progress of all work items identified in the PSP.

E. The costs of participation in the Executive Committee (including the cost to serve on the Study Management Team) shall be included in total project costs and cost shared in accordance with the provisions of this Agreement.

ARTICLE V - DISPUTES

As a condition precedent to a party bringing any suit for breach of this Agreement, that party must first notify the other party in writing of the nature of the purported breach and seek in good faith to resolve the dispute through negotiation. If the parties cannot resolve the dispute through negotiation, they may agree to a mutually acceptable method of non-binding alternative dispute resolution with a qualified third party acceptable to both parties. The parties shall each pay 50 percent of any costs for the services provided by such a third party as such costs are incurred. Such costs shall not be included in Study Costs. The existence of a dispute shall not excuse the parties from performance pursuant to this Agreement.

ARTICLE VI - MAINTENANCE OF RECORDS

A. Within 60 days of the effective date of this Agreement, the Government and the Sponsor shall develop procedures for keeping books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to this Agreement to the extent and in such detail as will properly reflect total Study Costs. These procedures shall incorporate, and apply as appropriate, the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to state and local governments at 32 C.F.R. Section 33.20. The Government and the Sponsor shall maintain such books, records, documents, and other evidence in accordance with these procedures for a minimum of three years after completion of the Study and resolution of all relevant claims arising therefrom. To the extent permitted under applicable Federal laws and regulations, the Government and the Sponsor shall each allow the other to inspect such books, documents, records, and other evidence.

B. In accordance with 31 U.S.C. Section 7503, the Government may conduct audits in addition to any audit that the Sponsor is required to conduct under the Single Audit Act of 1984, 31 U.S.C. Sections 7501-7507. Any such Government audits shall be conducted in accordance with Government Auditing Standards and the cost principles in OMB Circular No. A-87 and other applicable cost principles and regulations. The costs of Government audits shall be included in total Study Costs and shared in accordance with the provisions of this Agreement.

ARTICLE VII - RELATIONSHIP OF PARTIES

The Government and the Sponsor act in independent capacities in the performance of their respective rights and obligations under this Agreement, and neither is to be considered the officer, agent, or employee of the other.

ARTICLE VIII - OFFICIALS NOT TO BENEFIT

No member of or delegate to the Congress, nor any resident commissioner, shall be admitted to any share or part of this Agreement, or to any benefit that may arise therefrom.

ARTICLE IX - FEDERAL AND STATE LAWS

In the exercise of the Sponsor's rights and obligations under this Agreement, the Sponsor agrees to comply with all applicable Federal and State laws and regulations, including Section 601 of Title VI of the Civil Rights Act of 1964 (Public Law 88-352) and Department of Defense Directive 5500.11 issued pursuant thereto and published in 32 C.F.R. Part 195, as well as Army Regulations 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army".

ARTICLE X - TERMINATION OR SUSPENSION

A. This Agreement shall terminate at the conclusion of the Study Period, and neither the Government nor the Sponsor shall have any further obligations hereunder, except as provided in Article III.C.; provided, that prior to such time and upon thirty (30) days written notice, either party may terminate or suspend this Agreement. In addition, the Government shall terminate this Agreement immediately upon any failure of the parties to agree to extend the study under Article II.E. of this agreement, or upon the failure of the sponsor to fulfill its obligation under Article III. of this Agreement. In the event that either party elects to terminate this Agreement, both parties shall conclude their activities relating to the Study and proceed to a final accounting in accordance with Article III.C. and III.D. of this Agreement. Upon termination of this Agreement, all data and information generated as part of the Study shall be made available to both parties.

B. Any termination of this Agreement shall not relieve the parties of liability for any obligations previously incurred, including the costs of closing out or transferring any existing contracts.

ARTICLE XI - OBLIGATIONS OF FUTURE APPROPRIATIONS

A. Nothing herein shall constitute, nor be deemed to constitute, an obligation of future appropriations by the Department of Natural Resources of the State of Minnesota, where creating such an obligation would be inconsistent with the Minnesota Constitution Article XI, Section 1 and Minnesota Statutes Sections 16A.138 and 16A.15 Subd.3 of the State of Minnesota.

B. The Non-Federal Sponsor intends to fulfill its obligations under this Agreement. The Non-Federal Sponsor shall include in its budget request or otherwise propose appropriations of funds in amounts sufficient to fulfill these obligations for that biennium, and shall use all reasonable and lawful means to secure those appropriations. The Non-Federal Sponsor reasonably believes that funds in amounts sufficient to fulfill these obligations lawfully can and will be appropriated and made available for this purpose. In the event funds are not appropriated in amounts sufficient to fulfill these obligations, the Non-Federal Sponsor shall use its best efforts to satisfy any requirements for payments or contributions of funds under this Agreement from any other source of funds legally available for this purpose. Further, if the Non-Federal Sponsor is unable to fulfill these obligations, the Government may exercise any legal rights it has to protect the Government's interests related to this Agreement.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement, which shall become effective upon the date it is signed by the District Engineer for the U.S. Army Corps of Engineers, St. Paul District.

DEPARTMENT OF THE ARMY

BY ______________________
~~Colonel~~, Corps of Engineers
Deputy District Engineer for PM
St. Paul District

MINNESOTA DEPARTMENT OF NATURAL RESOURCES

BY ______________________
Commissioner

CERTIFICATION REGARDING LOBBYING

The undersigned certifies, to the best of his or her knowledge and belief that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

Mark Holsten

Mark Holsten
Commissioner, Minnesota Department of Natural Resources

DATE: 6/20/07

Appendix C – Correspondence

Agenda

Marsh Lake Ecosystem Restoration Project
Sponsor Coordination Meeting
December 18, 2009
Start: 9:00 AM

Purpose: Review and resolve outstanding issues related to the project Feasibility Study Report, update sponsor on status of project work items, coordinate efforts to complete study

1. **Recreational Project Features** (Bollman, conference call)
   a. Overview
   b. Pedestrian Bridge at Marsh Lake Spillway
   c. USACE Day Use Facility Improvements
   d. Pomme de Terre Canoe Access
   e. Interpretive Signage/Kiosks at Landings
   f. Other Features for Consideration?
2. **Project Status Update** (Wyatt)
   a. Funds Status
   b. Project Schedule/Upcoming Deadlines
3. **Feasibility Study Overview** (Wilcox)
   a. Review of Feasibility Study Draft
   b. Discussion Regarding Roles/Responsibilities in Completing the Report
4. **Breakwater Structure Discussion** (Open Discussion)
   a. Discussion of Form/Function
   b. Optimized Locations
   c. Decision
5. **Identification of Regulatory Issues** (Open Discussion)
   a. Overview of Project Partnership
   b. Identification of Issues
   c. Discussion

Marsh Lake Feasibility Study			
Activity ID	Activity Name	Start	Planned Finish
FEA2420	Plan Formulation - Federal	02-May-07 A	4-Jan-10
FEA2429	Feas Scoping Meeting		11-Dec-07
FEA2430	**AFB Project Doc**	**04-Jan-10***	**15-Jan-10**
FEA2440	AFB Tech Review	19-Jan-10	12-Feb-10
FEA2450	AFB Policy Compl	19-Jan-10	2-Mar-10
FEA2460	**Feas Alternative Formulation Briefing (AFB)**		**16-Apr-10**
FEA2470	AFB Guid. Memo	16-Apr-10	30-Apr-10
FEA2480	Draft Feas Rpt/NEPA	18-May-10	13-Jul-10
FEA2492	Conduct ITR (Future)	19-Jan-10	25-May-10
FEA2500	**Submit Draft Feas Report**		**13-Jul-10**
FEA2505	HQ Policy Compl Review	13-Jul-10	24-Aug-10
FEA2570	Feas Review Conference (FRC)		24-Aug-10
FEA2571	Feas Proj Guide Memo (PGM)		24-Aug-10
FEA2575	Feas Public Review Period Start	13-Jul-10	
FEA2577	Public Review Comments	13-Jul-10	24-Aug-10
FEA2580	Prepare Final Report & Summary	24-Aug-10	21-Sep-10
FEA2590	Issue Division Engineer's Transmittal Letter		21-Sep-10
FEA2600	All Other Final Feas	21-Sep-10	21-Sep-10
FEA2640	Wash. Level Policy Review	21-Sep-10	19-Oct-10
FEA2650	**CWRB Briefing/Approval**		**19-Oct-10**
FEA2655	Prepare Draft Chief's Report	19-Oct-10	26-Oct-10
FEA2657	State & Agency Review	26-Oct-10	6-Jan-11
FEA2658	Feas State/Agency Review Complete		6-Jan-11
FEA2660	Sign Feas Chief 's Report		6-Jan-11
FEA2670	ASA(CW) Review	6-Jan-11	20-Jan-11
FEA2700	ASA(CW) Memo to OMB		20-Jan-11
FEA2709	OMB Review & Comment	20-Jan-11	15-Apr-11
FEA2710	Feas Report to Congress		15-Apr-11

CEMVP-PD-F 21 December 2009

MEMORANDUM FOR RECORD

SUBJECT: Marsh Lake Feasibility Study – December 18, 2009 Sponsor Meeting
LOCATION: DNR Regional Office, New Ulm, MN
ATTENDEES: David Trauba (DNR, WMA), Josh Kavanagh (Ducks Unlimited), Ken Varland (DNR, Wildlife), John Schladweiler (DNR, Eco), Kristy Rice (DNR, Parks/Trails), Renee McGarvey (USACE), Chris Domeier (DNR, Fisheries), Michael Wyatt (USACE), Dan Wilcox (USACE), Skip Wright (DNR, Waters), Dorie Bollman (USACE, via conference call), Wendy Frohlich (USACE, via conference call)

INTRODUCTION: Wyatt introduced the USACE Team Members and provided a brief overview of the project, the partnership and the goals of the meeting which focused on resolving several outstanding issues in order to complete a draft of the Feasibility Study Report. The current draft was distributed to the project sponsor prior to the meeting along with a meeting agenda outlining topics for discussion.

1. RECREATIONAL PROJECT FEATURES: Bollman previously conducted a conference call with several DNR Staff to explore alternatives for recreational features associated with the project. Prior to the meeting, Bollman distributed a narrative for three sections of the report for review and comment. Bollman provided a recap of her discussions with DNR Staff as well as an overview of the initial list of recreational alternatives which included a pedestrian bridge at the Marsh Lake spillway, improvements to the USACE Day Use facilities, canoe access on the Pomme de Terre River, and interpretive signage around access points to Marsh Lake.

   Domeier indicated that through discussions with Norm Haukos (DNR, Fisheries; not present), that there is interest to increase access to shore fishing opportunities around the lake. Domeier noted that fishing access should consist of constructed access points that include a variety of rustic, natural access points as well as fishing areas that are universally accessible and Americans with Disabilities Act (ADA) compliant. A visual representation of a floating dock was presented to the group, however, it was agreed that shoreline fishing access should consist of a simpler design. Domeier suggested that a gravel footpath and slab rock along the shoreline would suffice for rustic access and that at other sites, the DNR has previously constructed ADA-compliant access composed of a design similar to a 8'x10' box culvert positioned vertically at the shoreline, filled with compacted gravel.

   NEXT STEPS: DNR Staff will identify locations and preferred designs for shore fishing opportunities for inclusion in the project. This will likely consist of one access point at Lewisburg Grade Road, three access points off of the upstream side of the spillway and one access point on the downstream side of the spillway. A map will be provided with locations for use in the study report. DNR will specify which of these access points should be ADA compliant.

   The group also discussed the pedestrian bridge over the spillway and the potential for a trail crossing Marsh Lake at the spillway to connect bike trails on either side of the Wildlife

Management Area (WMA). DNR Staff indicated that the current alternative should focus solely on the construction of a bridge over the spillway which is the primary impediment to pedestrian traffic through the area. Any future trail system will be constructed through a future project and will not be included for consideration in the current Marsh Lake Feasibility Study.

The group discussed canoe access at two locations on the site. Canoe access on the Pomme de Terre River will consist of a pull off area on the existing road-way, gravel footpath and rustic canoe launch along the rerouted river channel. It was also noted that portage opportunities should be provided for those traveling from Marsh Lake to lower Lac qui Parle. It was agreed that portage could be allowed through the parking lot at the USACE Day Use Facility on site.

NEXT STEPS: As a new alternative USACE will include a canoe portage at the Day Use Facility parking lot consisting of signage formalizing the portage path, rustic steps downstream of the parking lot, a gravel footpath and an access point on Marsh Lake.

The group reviewed proposed improvements to the existing USACE Day Use Facilities on the site. Incorporation of restrooms on site at the parking lot is the primary feature under consideration. USACE must coordinate with Staff on-site to gauge maintenance requirements capabilities for any improvements.

While not on the initial list of potential improvements, the group also discussed including constructed wildlife observation areas into the project. The group concluded that no such features would be considered within the current Feasibility Study.

NEXT STEPS: The final list of recreational alternatives to be considered in the Feasibility Study includes the following:

a. **Pedestrian bridge at the Marsh Lake spillway – this includes a bridge only, no trail at this time**
b. **USACE Day Use Facility improvements – USACE will discuss options internally to gauge maintenance capabilities on site for potential improvements**
c. **Canoe access – includes canoe access on the Pomme de Terre River and a portage site between Marsh Lake and Lac qui Parle**
d. **Interpretive signage/kiosks at landing sites – five access points were identified around the lake for signage; improvements would include a map referencing location and information regarding the ecology of the area**

2. PROJECT STATUS UPDATE: Wyatt reviewed the current project budget and schedule. A spreadsheet of key milestones was distributed in advance of the meeting. A draft of the Feasibility Study is scheduled to be completed and submitted for internal review within the USACE hierarchy on January 15, 2010. Wyatt noted that the project is currently on schedule however there is a significant amount of material such as construction quantities and cost estimates that must be completed prior to submittal of the draft report for the Alternatives Formulation Briefing. General review and comment by the DNR was requested for the current report draft. Other key milestones highlighted in the schedule included the submittal

of the full draft Feasibility Report on July 13, 2010 and the Civil Works Review Board Briefing on October 19, 2010.

Wyatt noted that all funds from the DNR required for the project have been received and in-kind service records will be important to track throughout the remainder of the study.

The group inquired about critical deadlines for future funding of a potential construction project. Wyatt explained that the Presidential Budget is typically submitted to Congress in February of each year. Congress coordinates with local constituencies regarding budget priorities from February through March and appropriations bills are subsequently drafted following the spring of each year. Wyatt cautioned that few appropriations bills have been approved prior to the September 30th (end of Federal Fiscal Year) deadline in recent years, however, this year the Corps received notice of appropriations fairly early, on November 1, 2009. It was suggested that while on-going coordination with Congressional representatives is important throughout the life of a project, that February to March period is the critical portion of the year in regards to upcoming project appropriations.

3. FEASIBILITY STUDY OVERVIEW: Wilcox provided an overview of the ecosystem restoration project components and issues covered in the Feasibility Study report. Wilcox noted that several of the inherent characteristics of the lake such as average depth, length of wind fetch and management of water levels contribute to sediment suspension and lack of water transparency which is in turn reflective of the degraded ecosystem condition of the lake. The overall goal of the project is to improve the water quality, ecosystem state, and fish and wildlife habitat for Marsh Lake. The alternatives evaluated in the report are targeted at achieving the stated goals and optimizing the benefits incurred with the project.

Wilcox reviewed the current project designs as well as the narrative of the various sections of the report, focusing on areas where more information is required from the DNR in order to complete the report.

NEXT STEPS: DNR will provide information related to:

- **Endangered and threatened species in and around the site; species includes both State and Federal listings (Schladweiler)**
- **Future land use (Trauba)**
- **DNR will identify a target elevation for a winter drawdown (Trauba/Varland)**

DNR Staff identified three issues of concern regarding downstream risks to public safety from the presence of a low-head dam, the application of the Habitat Evaluation Procedure (HEP) model and also inquired as to the design for the Lewisburg Road culverts. The Corps will likely design the Lewisburg Grade Road structure to function with removable stop logs, but will clarify the design in the coming weeks.

NEXT STEPS: USACE will investigate ways to minimize the risks to public safety with the low-head dam and finalize a draft design of the Lewisburg Grade Road site. A conference call will be conducted between USACE Staff and DNR (Trauba) to clarify the application of various HEP models for the project.

Wilcox identified project performance criteria (starting on page 109) and requested review and comment from DNR Staff. Performance criteria addresses objectives related to water quality, geomorphology, hydrology/hydraulics, habitat, biota, recreation and public safety.

NEXT STEPS: DNR will review and comment on performance criteria identified within the report.

Wilcox provided a detailed description of the USACE Planning Process identifying all of the alternatives considered for the project and the process by which alternatives were discarded or retained for further consideration within the report. It was generally agreed upon that the existing list of alternatives should be retained for further consideration in the report.

NEXT STEPS: The Feasibility Study will include the following alternatives:

- **Restore the Pomme de Terre River to its historic channel**
- **Modify Marsh Lake dam to attain target water levels/construct fishway**
- **Growing season drawdowns to restore emergent aquatic plants**
- **Winter drawdowus to reduce carp abundance**
- **Install gated culverts, Lewisburg Grade Road**
- **Breach dike at abandoned fish pond**
- **Construct islands in Marsh Lake**
- **Recreational project features (discussed above)**

4. BREAKWATER STRUCTURE DISCUSSION: In November, Wilcox arranged for a site visit for Varland and Trauba at Pool 10 on the Mississippi River where the Corps (in conjunction with the U.S. Fish & Wildlife Service) had previously constructed breakwater structures similar to those considered for Marsh Lake. Varland provided a photo-journal of the site visit to illustrate how the structures looked and functioned in the river ecosystem. The consensus between Varland and Trauba was that the breakwater structures on the Mississippi River appeared to serve the intended beneficial purpose to the wildlife habitat of the area and the application could be transferrable to Marsh Lake. Kavanagh noted that Ducks Unlimited had previously voiced concerns regarding the costs of the breakwater structures, but does not dispute the use of structures in principle. It was suggested that there is a significant supply of granite slabs in close vicinity to the project area that may suffice as a base to the breakwater structures and given the availability, it is likely the slabs could be acquired at a discount. Wilcox noted that islands were constructed in Mud Lake in conjunction with the Lake Traverse project in the winter by a contractor for Ducks Unlimited. Islands in Marsh Lake could also be constructed in winter after the lake is drawn down using locally-procured rock. The USACE will investigate appropriate construction methods.

   NEXT STEPS: USACE will include the breakwater structures as an alternative measure in the overall ecosystem restoration plan for the project (included above). A plan-view layout will be provided which identifies wildlife feeding and resting areas throughout the lake. In the design criteria, USACE will investigate whether granite slabs (3'x4') could be utilized at the base of the breakwater structures.

5. IDENTIFICATION OF REGULATORY ISSUES: Wyatt inquired as to any regulatory concerns with the project. It was suggested that changes to the dam operation may result in changes to the Ordinary High Water (OHW) elevation, a legal jurisdictional elevation established by the State of Minnesota.

   RESOLVED: DNR Waters will evaluate any necessary changes to the OHW or operations requirements during the design phase of the project.

   Wyatt also noted that based on a previous conversation between USACE and DNR Staff, it was unclear how impacts to mussel communities should be addressed with the rerouting of the Pomme de Terre River. USACE had previously proposed that mussels affected by the reroute could be harvested with a mussel dredge and relocated in upstream areas of the Pomme de Terre River. Downstream areas within the historic river channel would be monitored as an experiment to evaluate the distribution of mussels over time as mussels recolonize the historic river channel. This approach has been documented in the Draft Feasibility Report for DNR consideration and targets are identified in the performance criteria section of the report.

   NEXT STEPS: DNR will review and comment on the report language and performance criteria related to mussels. Wilcox will prepare a draft experimental design and cost estimate for the mussel relocation, monitoring and evaluation. This will be provided to the DNR for review.

If there are any questions, please contact the Project Manager, Michael Wyatt at 651.290.5216 or email at michael.d.wyatt@usace.army.mil.

Minnesota
Historical Society
STATE HISTORIC PRESERVATION OFFICE

June 3, 2010

Attn: Terry Birkenstock
Environmental & Economic Analysis Branch
U.S. Army Corps of Engineers
190 5th Street East
St. Paul, MN 55101-1638

RE: Marsh Lake Ecosystem Restoration, Lac Qui Parle WMA
Big Stone, Lac Qui Parle, and Swift counties
SHPO Number: 2009-0850

Dear Mr. Birkenstock:

Thank you for the opportunity to review and comment on recent revisions to the above project. They have been reviewed pursuant to the responsibilities given the State Historic Preservation Officer by the National Historic Preservation Act of 1966 and the Procedures of the Advisory Council on Historic Preservation (36CFR800).

We have the following comments on the revised proposal:

1. We note that the bank stabilization measures initially planned as part of this project have been deleted. Therefore, we find that the project will have **no adverse effect on archaeological resources** eligible for listing or included in the National Register of Historic places.

2. The Marsh Lake Dam has previously been determined eligible for inclusion in the National Register of Historic Places. We find that any of the **proposed spillway modification alternatives would constitute an adverse effect on the dam** because these modifications will substantially change the way the dam operates. Further, **the proposed channel modifications will adversely affect the historic setting of the dam.**

If you have not already done so, please notify the Advisory Council on Historic Preservation (ACHP) of the adverse effect, per the requirements of 36CFR800, to begin the consultation process.

From our standpoint, the stipulation we would like to see in the anticipated Memorandum of Agreement for this project would simply be the requirement to document the historic dam in its original condition, prior to making the proposed habitat improvement alterations. For this purpose, we ask that you use the Minnesota Property Record Guidelines, which were revised and updated last year. A Level II documentation should be sufficient for this purpose.

Virginia Gnabasik had suggested a conference call to further discuss the MOA contents. However, by dropping the bank stabilization aspects, you have simplified the project from an historic resource standpoint. Once the ACHP is contacted, and appropriate public outreach efforts are made, I think the MOA itself can be very straightforward and focus on documentation of the historic dam.

We look forward to working with you to complete this review. Contact us at (651) 259-3456 with questions or concerns.

Sincerely,

Mary Ann Heidemann, Manager
Government Programs & Compliance Unit

cc: Virginia Gnabasik, Corps of Engineers

Minnesota
Historical Society
STATE HISTORIC PRESERVATION OFFICE

June 3, 2010

Attn: Terry Birkenstock
Environmental & Economic Analysis Branch
U.S. Army Corps of Engineers
190 5th Street East
St. Paul, MN 55101-1638

RE: Marsh Lake Ecosystem Restoration, Lac Qui Parle WMA
Big Stone, Lac Qui Parle, and Swift counties
SHPO Number: 2009-0850

Dear Mr. Birkenstock:

Thank you for the opportunity to review and comment on recent revisions to the above project. They have been reviewed pursuant to the responsibilities given the State Historic Preservation Officer by the National Historic Preservation Act of 1966 and the Procedures of the Advisory Council on Historic Preservation (36CFR800).

We have the following comments on the revised proposal:

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We look forward to working with you to complete this review. Contact us at (651) 259-3456 with questions or concerns.

Sincerely,

Mary Ann Heidemann, Manager
Government Programs & Compliance Unit

cc: Virginia Gnabasik, Corps of Engineers

Minnesota
Historical Society
STATE HISTORIC PRESERVATION OFFICE

October 21, 2010

Attn: Randall D. Devendorf
Environmental and GIS Branch
U.S. Army Corps of Engineers
180 5th Street East, Suite 700
St. Paul, MN 55101-1638

RE: Marsh Lake Ecosystem Restoration, Lac Qui Parle WMA
Big Stone, Lac Qui Parle, and Swift counties
SHPO Number: 2009-0850 Draft MOA

Dear Mr. Devendorf:

Thank you for the opportunity to review and comment on the draft Memorandum of Agreement prepared for the above project. It has been reviewed pursuant to the responsibilities given the State Historic Preservation Officer by the National Historic Preservation Act of 1966 and the Procedures of the Advisory Council on Historic Preservation (36CFR800).

We have the following comments:

1. We are satisfied with the draft language as proposed. You may send a signature copy here when you are ready to proceed.

2. You mentioned that you have contacted the Advisory Council about the MOA, but had received no reply. We received a back copy of an ACHP reply dated April 9, 2010. A copy of that letter is enclosed for your reference. Unfortunately, the ACHP reply mentions a Programmatic Agreement, not an MOA. This is because your original Corps contact letter, dated March 22, 2010, mentioned a PA, rather than an MOA. I would advise contacting the ACHP and getting another letter with the correct reference.

3. Please be aware that the Minnesota Department of Transportation has just finished a major research document prepared to identify and evaluate the Lac Qui Parle Flood Control Historic District, as part of a bridge project in the area. This document includes much of the historic context information you will need in order to write the narrative portion of the documentation for the Marsh Lake Dam that is required by this MOA. You can probably save your historian time and money by getting a copy of the MnDOT study, and incorporating appropriate portions of that study into the Marsh Lake Dam documentation. The MnDOT project manager for the Lac Qui Parle Flood Control Historic District study is Jackie Sluss in the MnDOT Cultural Resources Unit. Jackie's phone number is (651) 366-3624. No sense reinventing the wheel with taxpayer dollars.

We look forward to working with you on the execution of this MOA, and completion of the required documentation. Contact us at (651) 259-3456 with any questions or concerns you may have.

Sincerely,

Mary Ann Heidemann

Mary Ann Heidemann, Manager
Government Programs & Compliance Unit

enclosure

cc: Virginia Gnabasik, Corps of Engineers

Preserving America's Heritage

April 9, 2010

Mr. Terry J. Birkenstock
Chief, Environmental and Economic Analysis Branch
Department of the Army
St. Paul District, Corps of Engineers
190 Fifth Street East, Suite 401
St. Paul, MN 55101-1638

Ref:* *Proposed Marsh Lake Dam Ecosystem Restoration Project
Swift, Lac qui Parle, and Big Stone Counties, Minnesota

Dear Mr. Birkenstock:

On March 26, 2010, the Advisory Council on Historic Preservation (ACHP) received your notification and supporting documentation regarding the development of a Programmatic Agreement (PA) for the referenced undertaking. Based upon the information you provided, we have concluded that Appendix A, *Criteria for Council Involvement in Reviewing Individual Section 106 Cases*, of our regulations, "Protection of Historic Properties" (36 CFR Part 800), does not apply to this undertaking. Accordingly, we do not believe that our participation in the consultation to develop this agreement is needed. However, if we receive a request for participation from the State Historic Preservation Officer (SHPO), a Tribal Historic Preservation Officer, an affected Indian tribe, a consulting party or other party, we may reconsider this decision. Additionally, should circumstances change and you determine that our participation is needed to conclude the consultation process, please notify us.

Pursuant to 36 CFR §800.6(b)(1)(iv), you will need to file the final PA, developed in consultation with the Minnesota SHPO and any other consulting parties, and related documentation with the ACHP at the conclusion of the consultation process. The filing of the PA and supporting documentation with the ACHP is required in order to complete the requirements of Section 106 of the National Historic Preservation Act.

Thank you for providing us with the opportunity to review this undertaking. If you have any questions or need assistance, please contact Tom McCulloch at 202-606-8554, or via email at tmcculloch@achp.gov.

Sincerely,

Raymond V. Wallace

Raymond V. Wallace
Historic Preservation Technician
Office of Federal Agency Programs

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
180 FIFTH STREET EAST, SUITE 700
ST. PAUL, MN 55101-1678

REPLY TO
ATTENTION OF

October 29, 2010

Regional Planning and Environment Division North
Environmental and GIS Branch

SUBJECT: Marsh Lake Dam Ecosystem Restoration Project, Minnesota River, Swift, Lac qui Parle, and Big Stone Counties, Minnesota

Dr. Tom McCulloch
Office of Federal Agency Programs
Advisory Council on Historic Preservation
Old Post Office Building, Suite 803
1100 Pennsylvania Avenue, NW
Washington, D.C. 20004

Dear Dr. McCulloch:

On March 22, 2010, the St. Paul District, U.S. Army Corps of Engineers sent you a letter describing their proposed Marsh Lake Dam Ecosystem Restoration Project on the Minnesota River in Swift, Lac qui Parle, and Big Stone Counties, Minnesota. In that letter we inquired per 36 CFR Part 800, section 800.11, whether the Advisory Council on Historic Preservation wished to become involved with this undertaking and its associated programmatic agreement. The Advisory Council's response letter, dated April 9, 2010, indicated that their participation in the consultation to develop the programmatic agreement was not needed (copy attached).

Since that date, the proposed Marsh Lake Dam Ecosystem Restoration Project has changed in that the shoreline protection measure has been dropped from consideration due to a natural armoring of the reservoir's shoreline area by glacial rocks previously eroded out and deposited along that shoreline. With this change in project plans, unevaluated archeological site 21BS67 on the shoreline of an island in lower Marsh Lake will not be affected by shoreline protection construction. In addition, the proposed stoplog or gated structures on the Louisburg Grade Road culverts will be used to maintain the existing pool level on upper Marsh Lake during any future drawdowns on lower Marsh Lake. Water level drawdowns are not necessary on upper Marsh Lake as it already has an abundance of aquatic vegetation for waterfowl use. Thus, unevaluated archeological sites 21LP36, 21BS42, 21BS47, and the historic granite quarry on upper Marsh Lake will not be affected by future drawdowns of either upper or lower Marsh Lake. All other proposed ecosystem restoration measures remain unchanged from our original coordination letter.

Marsh Lake Dam, which has been determined eligible to the National Register under criterion A, is now the only historic property which will be adversely affected by the proposed ecosystem restoration measures. As a result of this change in the proposed project, a Memorandum of Agreement (MOA) between the St. Paul District, U.S. Army Corps of

Engineers and the Minnesota State Historic Preservation Officer will be negotiated to cover mitigation of the impacts to Marsh Lake Dam, instead of the previously stated Programmatic Agreement. The Minnesota Department of Natural Resources, who is the non-Federal sponsor of this ecosystem restoration project, will be a concurring party to the MOA.

Because the potential impacts to possible National Register eligible archeological sites along the Marsh Lake shoreline will no longer occur as a result of the revised Marsh Lake Dam Ecosystem Restoration Project, the St. Paul District, U.S. Army Corps of Engineers is hereby asking if the Advisory Council wishes to be involved with the revised undertaking and its associated Memorandum of Agreement to cover mitigation of adverse effects to National Register-eligible Marsh Lake Dam. Please provide your response by November 30, 2010. If you have any questions on any of the ecosystem restoration measures, please contact St. Paul District Corps archeologist Virginia Gnabasik at (651) 290-5262 or by email at virginia.r.gnabasik@usace.army.mil.

Sincerely,

Randall D. Devendorf
Acting Chief, Environmental and GIS Branch

Enclosure
ACHP ltr dated 4/9/10

Preserving America's Heritage

April 9, 2010

Mr. Terry J. Birkenstock
Chief, Environmental and Economic Analysis Branch
Department of the Army
St. Paul District, Corps of Engineers
190 Fifth Street East, Suite 401
St. Paul, MN 55101-1638

Ref: Proposed Marsh Lake Dam Ecosystem Restoration Project
Swift, Lac qui Parle, and Big Stone Counties, Minnesota

Dear Mr. Birkenstock:

On March 26, 2010, the Advisory Council on Historic Preservation (ACHP) received your notification and supporting documentation regarding the development of a Programmatic Agreement (PA) for the referenced undertaking. Based upon the information you provided, we have concluded that Appendix A, *Criteria for Council Involvement in Reviewing Individual Section 106 Cases*, of our regulations, "Protection of Historic Properties" (36 CFR Part 800), does not apply to this undertaking. Accordingly, we do not believe that our participation in the consultation to develop this agreement is needed. However, if we receive a request for participation from the State Historic Preservation Officer (SHPO), a Tribal Historic Preservation Officer, an affected Indian tribe, a consulting party or other party, we may reconsider this decision. Additionally, should circumstances change and you determine that our participation is needed to conclude the consultation process, please notify us.

Pursuant to 36 CFR §800.6(b)(1)(iv), you will need to file the final PA, developed in consultation with the Minnesota SHPO and any other consulting parties, and related documentation with the ACHP at the conclusion of the consultation process. The filing of the PA and supporting documentation with the ACHP is required in order to complete the requirements of Section 106 of the National Historic Preservation Act.

Thank you for providing us with the opportunity to review this undertaking. If you have any questions or need assistance, please contact Tom McCulloch at 202-606-8554, or via email at tmcculloch@achp.gov.

Sincerely,

Raymond V. Wallace

Raymond V. Wallace
Historic Preservation Technician
Office of Federal Agency Programs

ADVISORY COUNCIL ON HISTORIC PRESERVATION
1100 Pennsylvania Avenue NW, Suite 803 ▫ Washington, DC 20004
Phone: 202-606-8503 ▫ Fax: 202-606-8647 ▫ achp@achp.gov ▫ www.achp.gov

Preserving America's Heritage

November 15, 2010

Mr. Randall D. Devendorf
Acting Chief, Environmental and GIS Branch
Department of the Army
St. Paul District, Corps of Engineers
190 Fifth Street East, Suite 401
St. Paul, MN 55101-1638

Ref: Proposed Modifications to the Marsh Lake Dam Ecosystem Restoration Project
Swift, Lac qui Parle, and Big Stone Counties, Minnesota

Dear Mr. Devendorf:

On November 2, 2010, the Advisory Council on Historic Preservation (ACHP) received your notification and additional supporting documentation regarding the adverse effects of the referenced undertaking on properties listed or eligible for listing in the National Register of Historic Places. Based upon this additional information you have provided, we continue to believe that out participation to resolve adverse effects and develop an agreement document is not needed for this project. However, should circumstances change, and you determine that our participation is needed to conclude the consultation process, please notify us.

Pursuant to 36 CFR §800.6(b)(1)(iv), you will need to file the final Memorandum of Agreement (MOA), developed in consultation with the Minnesota State Historic Preservation Office (SHPO) and any other consulting parties, and related documentation with the ACHP at the conclusion of the consultation process. The filing of the MOA and supporting documentation with the ACHP is required in order to complete the requirements of Section 106 of the National Historic Preservation Act.

Thank you for providing us with the opportunity to review this undertaking. If you have any questions or need assistance, please contact Tom McCulloch at 202-606-8554, or via email at tmcculloch@achp.gov.

Sincerely,

Raymond V. Wallace

Raymond V. Wallace
Historic Preservation Technician
Office of Federal Agency Programs

MEMORANDUM OF AGREEMENT BETWEEN THE U.S. ARMY CORPS OF ENGINEERS, ST. PAUL DISTRICT, AND THE MINNESOTA STATE HISTORIC PRESERVATION OFFICER REGARDING MITIGATION OF ADVERSE EFFECTS TO MARSH LAKE DAM RESULTING FROM THE MARSH LAKE ECOSYSTEM RESTORATION PROJECT, SWIFT, LAC QUI PARLE AND BIG STONE COUNTIES, MINNESOTA

[Final – November 2010]

WHEREAS, the St. Paul District, U.S. Army Corps of Engineers (Corps) is conducting a feasibility study of ecosystem restoration measures at Marsh Lake on the Minnesota River in Swift, Lac Qui Parle, and Big Stone Counties, Minnesota; and

WHEREAS, the State of Minnesota, Department of Natural Resources (DNR) is the main landowner around Marsh Lake, as the Lac Qui Parle Wildlife Management Area, and is the non-Federal sponsor of this ecosystem restoration feasibility study; and

WHEREAS, the Corps and Minnesota DNR are proposing an ecosystem restoration project at Marsh Lake on the Minnesota River (Project) with the following primary features (a-g) and optional features (h-j) (see Figures 1 and 2):

a. Restoring the Pomme de Terre River to its former (pre-dam) channel by excavating an opening through the Marsh Lake Dam embankment and constructing three earthen berms or cutoff dikes across two low areas and the abandoned diverted river channel above the dam embankment to prevent Marsh Lake from spilling into the restored river channel;

b. Constructing a bridge over the restored Pomme de Terre River channel at the embankment to allow continued vehicle access to the dam;

c. Modifying Marsh Lake Dam at its outlet by excavating a 2.1-foot-deep, 30-foot-wide notch into the existing fixed ogee crest spillway and constructing a nine-tier rock-ramp fishway to allow fish passage between Marsh Lake and the Lac Qui Parle Reservoir downstream;

d. Constructing a new 90-foot-wide gated water control structure with 12 bays at the existing emergency spillway to enable future water level management of Marsh Lake;

e. Adding walkways over the existing fixed crest spillway and fishway and over the gated water control structure to allow access across the entire dam, which walkways could serve a secondary recreational purpose as part of the Minnesota River State Trail for pedestrian and bicycle traffic;

f. Breaching the abandoned fish rearing pond levee below the dam embankment to allow it to change water level with the rest of upper Lac Qui Parle Reservoir to provide seasonally variable habitat for fish and shorebirds;

g. Constructing three linear, rock wave-barrier islands in Marsh Lake between the dam and Louisburg Grade Road to reduce wind fetch and thereby shoreline erosion;

h. Adding stoplog structures to the six concrete culverts through Louisburg Grade Road to enable separate water level management in upper Marsh Lake;

i. Improving the recreation area at Marsh Lake Dam, including adding an interpretive kiosk, adding a canoe and kayak landing/launch area near the spillway for access to the Pomme de Terre River and Minnesota River/upper Lac qui Parle Reservoir, and adding shoreline fishing and wildlife viewing platforms; and,

j. Improving recreational and educational features at six existing boat ramps (Upper Pool Landing, Minnesota River Landing, Correll Landing, Killen Landing, Cabin Site Landing, and Peterson Landing) on Marsh Lake by adding interpretative kiosks and shoreline fishing/wildlife viewing platforms. Additional parking would also be provided at the Minnesota River Landing.

WHEREAS, Marsh Lake Dam (SW-APT-003) has been determined individually eligible to the National Register of Historic Places under Criterion A for its association with the Lac Qui Parle Flood Control Project, a Works Progress Administration project of the Federal Relief Programs following the Great Depression in 1929, and retains its integrity of original location, design, setting, materials, workmanship, feeling and association, and will be directly affected by proposed ecosystem restoration features a, b, c, and d, and restoration/recreation feature e, which will substantially change the historic setting of the dam and the way the dam operates and;

WHEREAS, proposed ecosystem restoration features c and d will also change the way Marsh Lake Dam is operated;

NOW, THEREFORE, the Corps, the Minnesota Department of Natural Resources, and the Minnesota State Historic Preservation Officer (SHPO) agree that upon filing this Memorandum of Agreement (MOA) with the Advisory Council on Historic Preservation, and upon the Corps' decision to proceed with the Marsh Lake ecosystem restoration project, the Corps shall ensure that the following stipulations are implemented prior to construction in order to mitigate the effects of the undertaking on the National Register eligible Marsh Lake Dam and comply with Section 106 of the National Historic Preservation Act, as amended.

STIPULATIONS

The Corps, as the Federal agency undertaking the Project, shall ensure the following stipulations are complied with prior to construction of ecosystem restoration features a, b, c, d, and e to mitigate adverse effects to Marsh Lake Dam's integrity of design, setting, and feeling. The proposed spillway modifications will also substantially change the way the dam operates.

A. The Corps or its contractor will document the historic Marsh Lake Dam property in its original and present condition, using Level II documentation as described in the *Minnesota Historic Property Record Guidelines* (updated June 2009 version). Level II documentation consists of: 1) a Minnesota Historic Property Record (MHPR) Background Data Form; 2) a brief two-page narrative description of the historic property (i.e., Marsh Lake Dam, SW-APT-003), its history, and a bibliography; and 3) documentation photography (black-and-white, 35 mm Kodak TMAX ISO 100 print film) covering historic photographs of Marsh Lake Dam, of the existing dam with its embankment and related features, and of historic plans and drawings of Marsh Lake Dam. Photographic documentation will follow the requirements given in Appendix E in the MHPR Guidelines.

B. The Corps will provide copies of the completed MHPR Level II documentation for Marsh Lake Dam to the Minnesota SHPO, to the Minnesota DNR's Regional Office, to the Lac qui

Parle Wildlife Management Refuge, and to the Swift, Big Stone, and Lac Qui Parle County Historical Societies.

C. Dispute Resolution. Should any of the signatory parties to this MOA object to any plans, documents, or reports prepared under the terms of this MOA within 30 days after receipt, the Corps shall consult with the objecting party to resolve the objection. If the Corps determines that the objection cannot be resolved, the Corps shall forward all documentation on the dispute to the Advisory Council on Historic Preservation. Any recommendation or comment provided by the Advisory Council will be understood to pertain only to the subject of the dispute. The Corps' and the Minnesota DNR's responsibilities to carry out all actions under this MOA that are not the subject of the dispute will remain unchanged.

D. Amendments. Any signatory party to this MOA may request that it be amended, whereupon the parties will consult to consider such amendment.

E. Termination. Any signatory party to this MOA may terminate it by providing thirty (30) days notice to the other parties, provided that the parties will consult during the period prior to termination to seek agreement on amendments or other actions that would avoid termination.

F. Anti-Deficiency Provision. All obligations on the part of the Corps shall be subject to the availability and allocation of appropriated funds for such purposes. Should the Corps be unable to fulfill the terms of this agreement, it will immediately notify the Minnesota SHPO and the Minnesota DNR and consult to determine whether to amend or terminate the MOA pending the availability of resources.

G. Sunset Clause. This MOA will continue in full force and effect until the mitigation of adverse effects to the National Register-eligible Marsh Lake Dam by the proposed ecosystem restoration features has been completed as stipulated above, unless the proposed features are not constructed or authorization for their construction is rescinded.

Execution and implementation of this Memorandum of Agreement evidences that the Corps has satisfied its Section 106 responsibilities for all aspects of this undertaking.

ST. PAUL DISTRICT, U.S. ARMY CORPS OF ENGINEERS

BY: ______________________ Date: 22 November 2010
Col. Michael J. Price, District Engineer

MINNESOTA STATE HISTORIC PRESERVATION OFFICER

BY: ______________________ Date: 11/30/10
Britta Bloomberg, Deputy State Historic Preservation Officer

Concur:

MINNESOTA DEPARTMENT OF NATURAL RESOURCES

BY: ______________________________ Date: ____________________

Mark Matuska, Regional Director

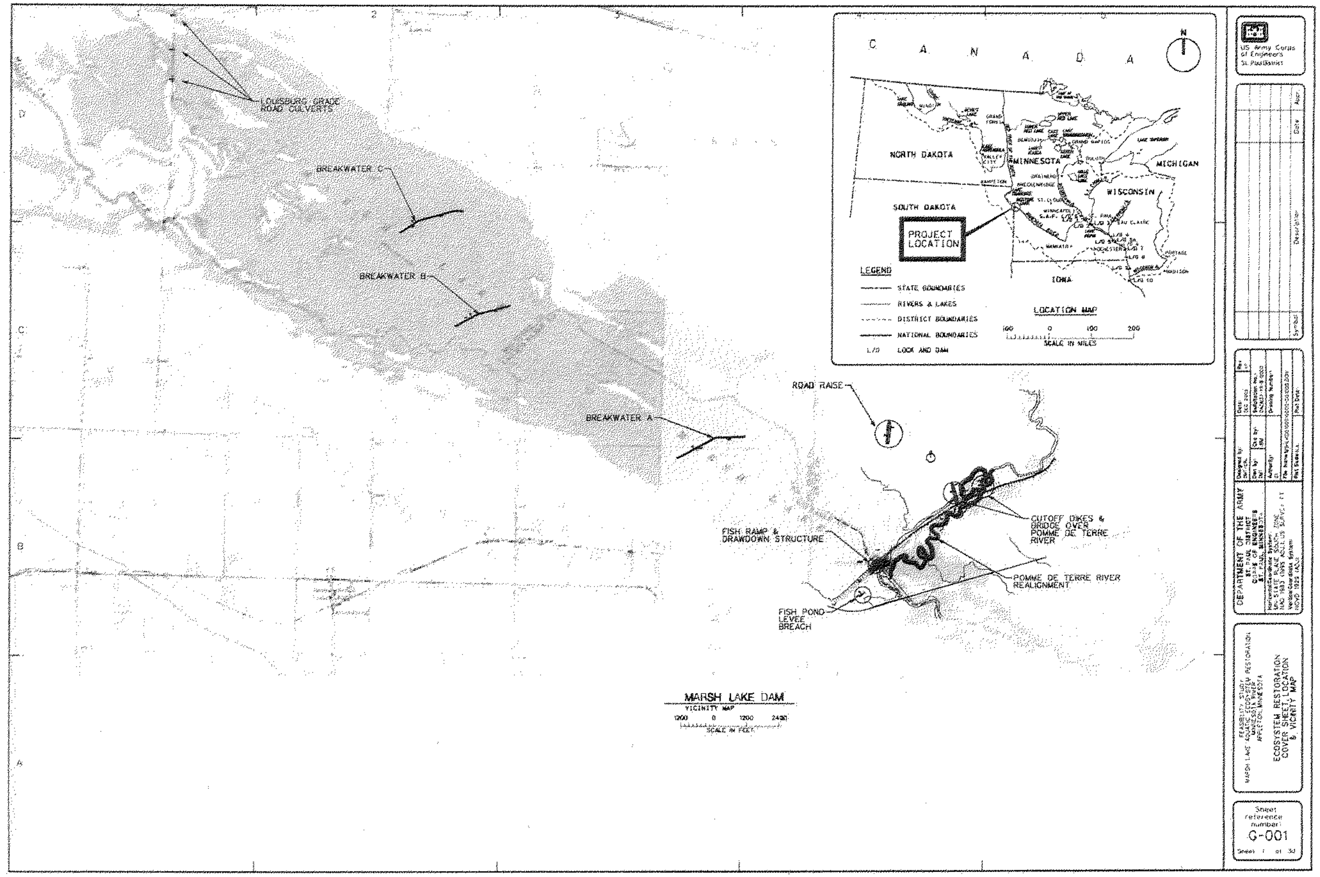


Figure 1. Marsh Lake Ecosystem Restoration Project, location of features a through h.

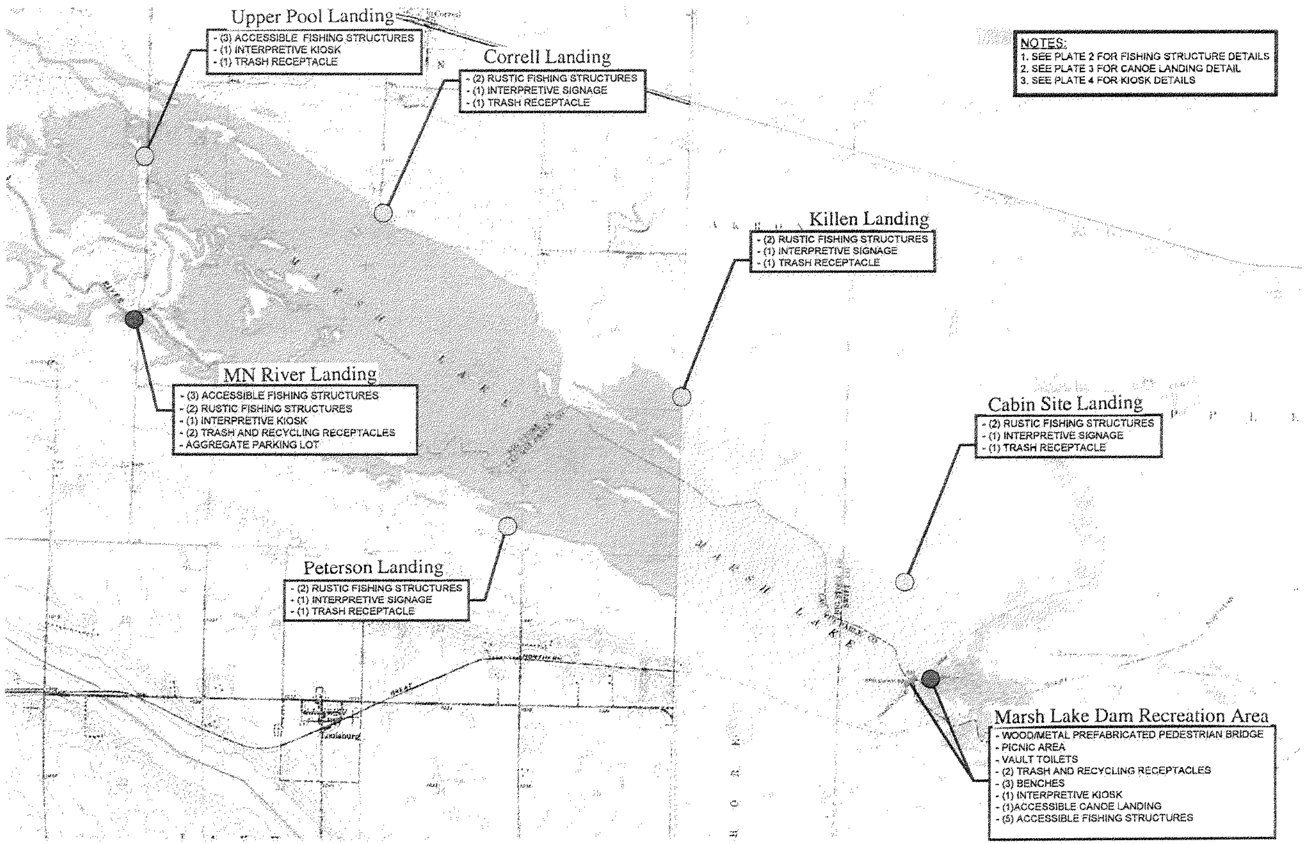


Figure 2. Marsh Lake Ecosystem Restoration Project, location of recreation features i and j.

Wyatt, Michael MVP

Subject: FW: Marsh Lake MN River Ecosystem Restoration Project (UNCLASSIFIED)

-----Original Message-----
From: Wilcox, Daniel B MVP
Sent: Monday, January 24, 2011 3:09 PM
To: Richard Davis (Richard Davis@fws.gov)
Cc: Wyatt, Michael MVP; Clark, Steven J MVP; Ken Varland (Ken.Varland@dnr.state.mn.us); David Trauba (David.Trauba@dnr.state.mn.us)
Subject: Marsh Lake MN River Ecosystem Restoration Project (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: FOUO

Richard,

Good to talk to you today. This is a request for ESA coordination.

The St. Paul District is preparing a feasibility report about an ecosystem restoration project at Marsh Lake, part of the Lac Qui Parle Flood Control Project on the Minnesota River. The Minnesota DNR is the non-federal cost share partner on this project. The primary project area is in the Lac Qui Parle Wildlife Management Area. Ken Varland (telephone 507/359-6030) and Dave Trauba (telephone 320-734-4451 x227) are our primary contacts with the MN DNR. Alice Hanley (telephone 320-273-2191), Refuge Manager of the Big Stone National Wildlife Refuge has participated in the planning of this project. An initial draft of the feasibility report/EA is available on our .ftp server at:
ftp://ftp.usace.army.mil/pub/mvp/MarshLakeFeasibilityReportEA/

I would like to coordinate ESA for this project with you by email. If you need a formal letter, please let me know.

The project within the MN DNR Lac qui Parle Wildlife Management Area. There are no federally-listed threatened or endangered species that may be found in the project area.

Please provide a response to this determination. We would like to have documentation of ESA coordination from you by email by February 9 for the Alternatives Formulation Briefing (a planning policy review of the project with our Division and Headquarters).

Also please advise on anything else we need to provide to fulfill our requirements for the project under the federal ESA and the FWCA.

Please call if you have any questions. Thanks for your help with this promising project.

Dan

Daniel B. Wilcox
Fisheries Biologist
Environmental and GIS Branch
US Army Corps of Engineers
St. Paul District
180 5th St. East
Suite 700
St. Paul MN 55101-1678

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Twin Cities Field Office
4101 American Blvd E.
Bloomington, Minnesota 55425-1665

July 12, 2011

Terry Birkenstock, Chief
Environmental and GIS Branch
St. Paul District Corps of Engineers
180 5th Street East, Suite 700
St. Paul, Minnesota 55101-1678

Re: Draft Marsh Lake Ecosystem Restoration Project Feasibility Report
Fish and Wildlife Coordination Act Correspondence
FWS TAILS #32410-2011-CPA-0088

Dear Mr. Birkenstock:

Pursuant to the Fish and Wildlife Coordination Act (FWCA), the Service and the U.S. Army Corps of Engineers (Corps) must coordinate and determine potential biological and ecological impacts of proposed projects. To date, Manger Alice Hanley of the Big Stone National Wildlife Refuge has participated with the Corps staff in the planning process for this project. This letter is intended to provide a singular document identifying the Service's input to date.

The following comments are being provided pursuant to the Endangered Species Act (ESA), the Migratory Bird Treaty Act (MBTA), the Bald and Golden Eagle Protection Act, and the Fish and Wildlife Coordination Act. This information is being provided to assist the Corps in making an informed decision regarding wildlife issues, site selection, project design, and compliance with applicable laws.

Federally-listed Threatened, Endangered, and Candidate Species

Currently, the Dakota skipper (Candidate) is present within Big Stone, Lac qui Parle, and Swift Counties, Minnesota. Our records do not indicate any Dakota skippers within the proposed project area. The Poweshiek skipper is currently under consideration to be listed as a Candidate species under the Endangered Species Act, and there are records of Poweshiek skippers within the proposed project area. Dakota and Poweshiek skippers prefer native prairie habitats. It is our understanding that the proposed project will not affect, directly or indirectly, any native prairie areas.

If at any point during project planning, construction, or operation, additional information on listed or proposed species becomes available, or new species are listed that may be affected by the project, consultation should be reinitiated with the Twin Cities Field Office.

Migratory Birds

The Migratory Bird Treaty Act (16 U.S.C. 703-712; MBTA) implements four treaties that provide for international protection of migratory birds. The MBTA prohibits taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior. Bald and golden eagles are afforded additional legal protection under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d). Unlike the Endangered Species Act, neither the MBTA nor its implementing regulations at 50 CFR Part 21 provide for permitting of "incidental take" of migratory birds.

Our records indicate the presence of one bald eagle nest in close proximity to the abandon fish-rearing pond referenced in the Draft Report, which could be affected by the project. Verification of the location and the activity status of the nest should be completed prior to completing any construction within 660 feet of the nest site.

Records indicate the past and/or current use of Marsh Lake by several colonial water-nesting bird species; American pelican, great blue heron, great egret, double crested cormorant, Forester's tern, black crowned night heron, and ring billed gulls. Development of a construction timeline to minimize impacts to these areas during prime nesting times should be considered. The Service recommends that proposed construction and excavation within potential bird nesting habitat be completed outside of the primary nesting period (April 1to August 31) when possible and feasible. Attempts to minimize impacts to potential migratory bird nesting habitats should be made at all times during construction and excavation.

Service-owned Lands

The Hastad, Hegland, and Plover Waterfowl Production Areas (WPAs) are within the proposed project area. Several private land tracts held under Conservation and Wetland Easement by the Service are also within the project area. Proposed project activities are not anticipated to have a negative impact on Service-owned or easement lands.

The proposed project should provide benefits in the way of wetland habitat improvement, aquatic vegetation establishment, increased fish passage, and increased species diversity. Thank you for the opportunity to provide comments on this proposed project. Please contact Fish and Wildlife Biologist Rich Davis at 612-725-3548 (ext. 2214) or me (ext. 2201) if we may be of further assistance.

Sincerely,

Tony Sullins
Field Supervisor

Cc: Alice Hanley, Project Leader - Big Stone NWR/WMD

CORPS OF ENGINNEERS RESPONSE TO FISH AND WILDLIFE SERVICE FWCA RECOMMENDATIONS

The U.S. Fish and Wildlife Service made two recommendations regarding avoiding or minimizing effects on Migratory Bird:

1. Verify the location and activity status of the currently known Bald Eagle nest that is in proximity of the abandoned fish rearing ponds before initiating any construction within 660 feet of the nest.

Response: The location and status of any known eagle nests in the project area will be evaluated prior to initiating construction. Coordination will be initiated with the USFWS if active eagle nests are located in or near proposed construction area.

2. Construction timing should be developed to minimize impacts of colonial nesting bird that may use the area.

Response: If possible/feasible, construction will be timed to avoid disturbance during critical nesting/rearing periods. BMP's will be used to minimize impacts to migratory bird nesting habitats during construction.

Appendix D – Section 404 Certification

Appendix D

Section 404(b)(1) Evaluation

Marsh Lake Ecosystem Restoration Project
Minnesota River

Big Stone, Lac qui Parle, and Swift Counties, Minnesota

June 2011

I. PROJECT DESCRIPTION

A. Location - The proposed fill activity would take place in Marsh Lake on the Minnesota River and in the Lower Pomme de Terre River located in western Minnesota (Figures 1 and 2). Lac qui Parle and Marsh Lake Reservoirs form boundaries for Lac qui Parle, Chippewa, Swift, and Big Stone Counties.

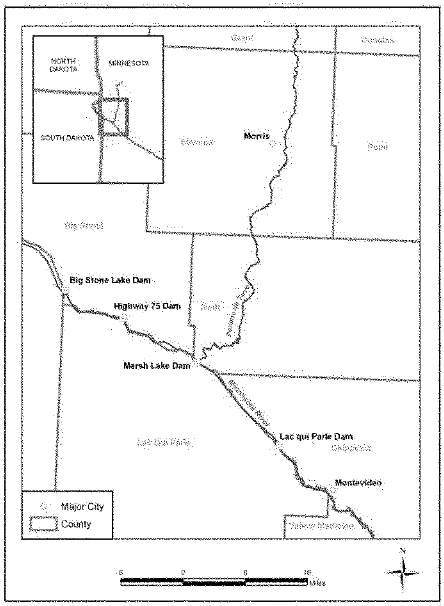


Figure 1. Marsh Lake Dam location on the Minnesota River in western Minnesota.

B. General Description - The proposed fill activities would consist of modifications to the Marsh Lake Dam to enable passive and active water level management and provide for fish passage between Lac qui Parle Lake and Marsh Lake and the Pomme de Terre River. This would include construction of a fishway in the overflow spillway and a stoplog water control structure in the embankment adjacent to the spillway (Figures 3 and 4).

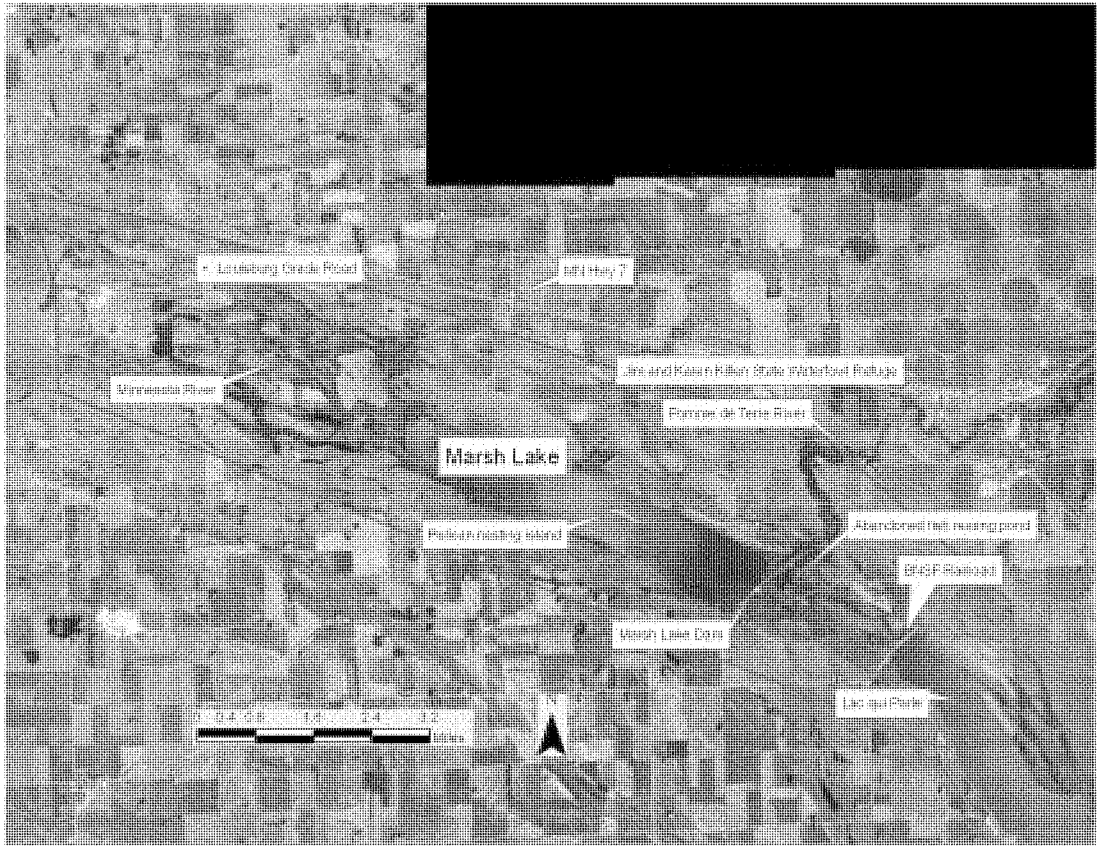


Figure 2. Marsh Lake project area boundary. Minnesota River flowing left to right. Marsh Lake Dam at right center. Pomme de Terre River entering from upper right. Farm Service Agency 2003 photo.

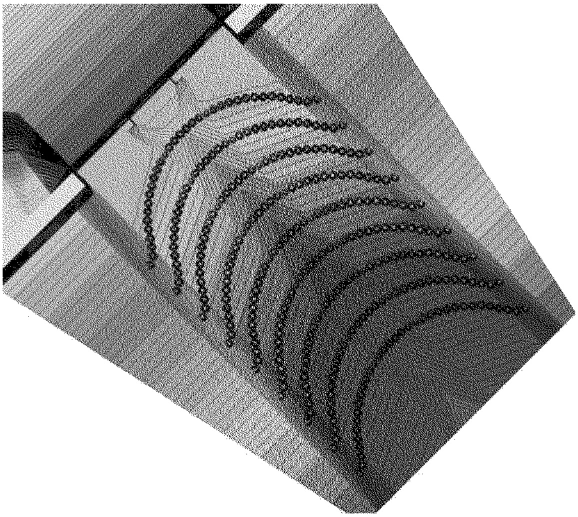


Figure 3. Conceptual design of a Marsh Lake fishway. Flow from upper left to lower right.

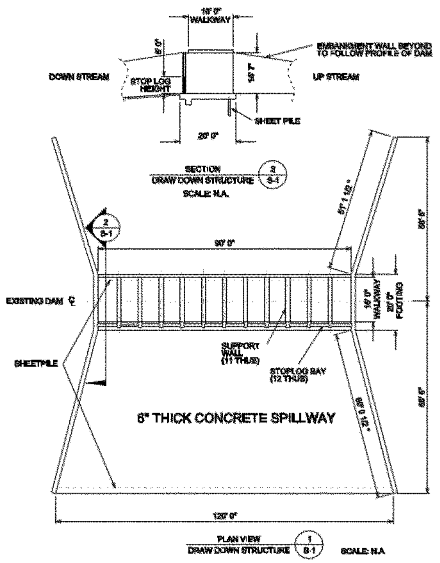


Figure 4. Conceptual design of a stop log water control structure for the Marsh Lake Dam.

Restoring the Pomme de Terre River to its former channel near its confluence with the Minnesota River would include construction of three cut-off berms and a bridge over the Pomme de Terre River to maintain access to the Marsh Lake Dam (Figure 5).

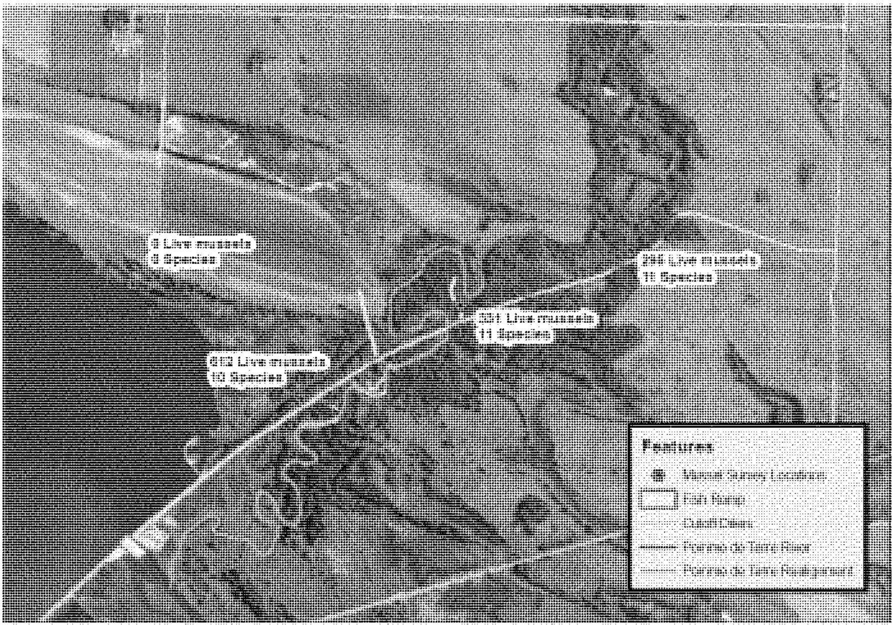


Figure 5. Pomme de Terre River existing channel (purple), realignment into former channel (blue), earthen cut-off dikes (green)

The abandoned fish rearing pond next to the Marsh Lake Dam would be reconnected with the upper end of Lac qui Parle. Breaching the fish pond dike on the downstream side of the Marsh Lake Dam would provide connectivity between the fish pond area and the upper end of Lac qui Parle, allowing native floodplain vegetation to become established and providing seasonally variable habitat for fish and shorebirds.

Installing gated culverts in the Louisburg Grade Road would enable water level management in upper Marsh Lake (Figures 6 and 7) during years when Marsh Lake is intentionally drawn down to restore aquatic vegetation.


Figure 6. Existing culverts under the Louisburg Grade Road at the upper end of Marsh Lake.

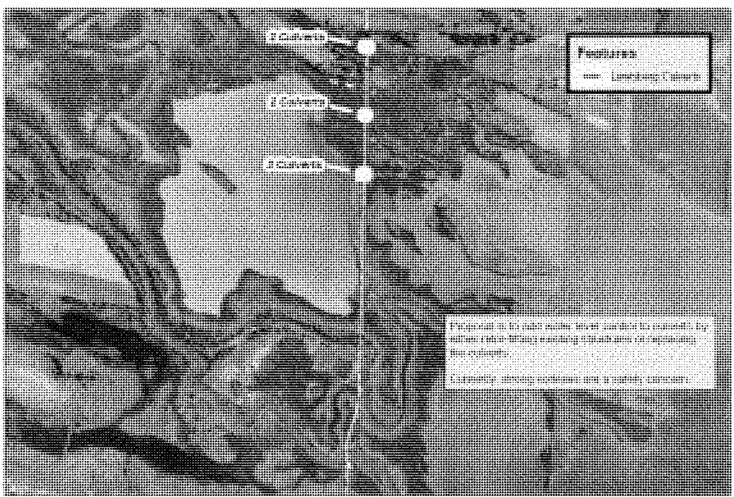


Figure 7. Location of culverts under the Louisburg Grade Road at the upper end of Marsh Lake.

Recreational and educational features would be constructed, including a trail bridge over Marsh Lake Dam to connect with the Minnesota State Trail, shore fishing access sites at six locations on Marsh Lake, canoe access on the Pomme de Terre River, and an improved recreation area at Marsh Lake Dam.

Figure 8. Example of an accessible shore fishing platform.

C. Authority and Purpose - The Marsh Lake feasibility study was authorized by a Resolution of the Committee on Public Works of the U.S. House of Representatives, May 10, 1962. The resolution reads as follows:

> "Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors be, and is hereby, requested to review the report of the Chief of Engineers on the Minnesota River, Minnesota, published as House Document 230, 74th Congress, First Session and other pertinent reports, with a view to determining the advisability of further improvements in the Minnesota River Basin for navigation, flood control, recreation, low flow augmentation, and other related water and land resources."

The purpose of this document is to comply with Section 404(b)(1) of the Clean Water Act pertaining to guidelines for placement of dredged or fill material into the waters of the United States. This evaluation also provides information and data to the Minnesota Pollution Control Agency demonstrating compliance with State water quality standards for the decision-making process about State 401 water quality certification.

D. Description of Dredged or Fill Material

Project Features Including Dredged or Fill Material

Modifications to the Marsh Lake Dam would include modifying the fixed crest spillway by constructing a fishway and construction of a gated stoplog structure. 1900 tons of large (1.6 ft diameter and larger boulders for weirs) rock would be used in the fishway channel. Riprap and bedding (10,000 tons) would be used to armor the fishway channel tying in to the existing embankment and in the downstream scour hole. The gated stoplog structure would also be armored with riprap and bedding (16,144 tons) tying in to the existing embankment and in the tailwater connecting to the Minnesota River. The embankments on the sides and downstream of the fishway and stoplog structure would be constructed with 23,350 cy of impervious fill. Material excavated from the work area for the fishway and stoplog structure would be transported to an upland placement site.

Restoring the Pomme de Terre River to its former channel would involve constructing two new sections of embankment to separate the Marsh Lake pool from the re-routed section of the Pomme de Terre River (left two green lines in Figure 5 above). The new embankments would be constructed to an elevation equal to spillway design flow elevation plus 5 feet of freeboard, or an elevation of 952.1 ft. Rock riprap against wave action would be necessary for the lake side of the new embankments. Rock riprap would be placed to a top elevation equal to rock riprap on the existing embankment (942.0 ft). A diversion plug is needed to divert the Pomme de Terre River into its historic channel in the area upstream of Marsh Lake Dam (right green line in Figure 5 above). Impervious clay fill material for the new embankments and diversion plug (31,596 cy) would be borrowed from a nearby upland site (Figure 9).

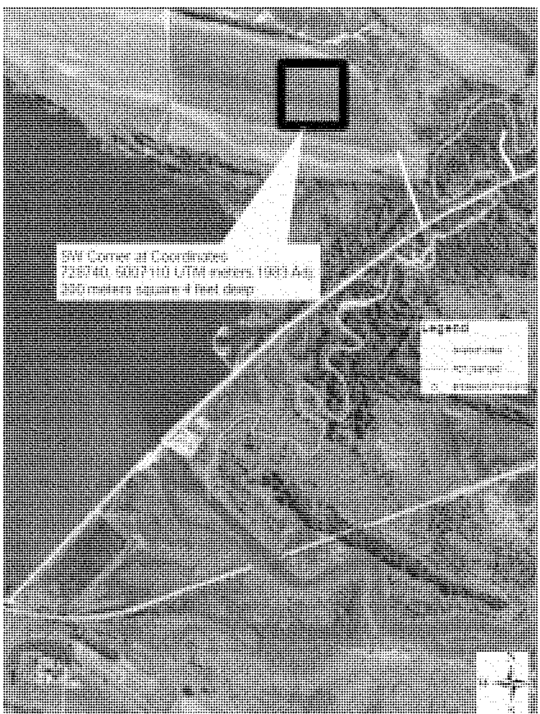


Figure 10. Borrow location for material to construct new embankments and diversion plug for re-routing the Pomme de Terre River to its former channel.

A five-span concrete bridge 450 ft long would be constructed over the Pomme de Terre River where it is re-routed through the Marsh Lake Dam embankment. The bridge piers would contain 90 cubic yards (cy) of concrete and footings, of which approximately one half would be in the water.

In-channel erosion control structures would be necessary to prevent head-cutting in the Pomme de Terre River channel that could threaten the Marsh Lake embankment and new bridge. Four erosion control structures (Figure 11) would be constructed near the mouth of the Pomme de Terre River and the highest located slightly upstream of the re-routed reach. Fill for these structures would be approximately 2000 cy of granite rock from local quarries. The rock would not be obtained by mining native prairie areas.

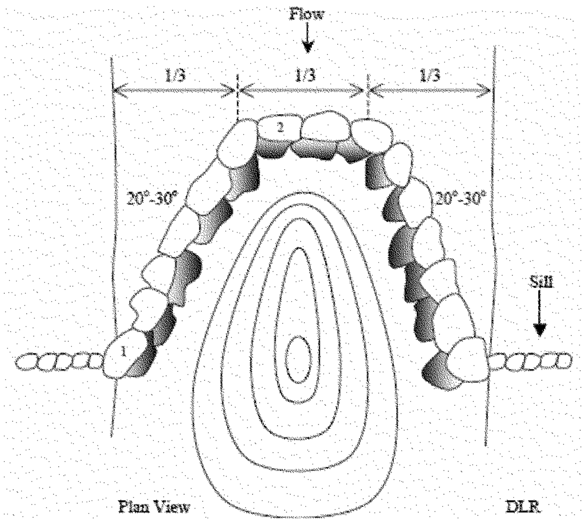


Figure 11. Rock erosion control structures to be constructed in the re-routed Pomme de Terre River Channel.

The abandoned fish rearing pond dike would be breached by removing 650 cy of fill and transporting it to an upland site.

The seven existing culverts under the Louisburg Grade Road would be removed and replaced with gated culverts. Approximately 210 cy of granite rock approximately 1 ft in diameter would be obtained from local quarries to armor the upstream and downstream ends of the culverts.

Shore fishing sites at six locations around Marsh Lake would be constructed. Two of the sites would be handicapped-accessible and constructed with pre-cast 8 ft x 8 ft concrete box culverts (Figure 9 above). The other recreational fishing shoreline accesses would be constructed with 4 ft x 8 ft slabs of locally quarried granite rock.

E. Description of the Proposed Discharge Sites

The fishway and stoplog control structure would be constructed in the Marsh Lake Dam at the existing fixed crest spillway. This construction activity would affect a 5.0 acre area of the existing dam and Minnesota River tailwater. Modifications to the Marsh Lake Dam would also alter 1.1 acres of Marsh Lake with excavation to deepen the approach to the fishway, scour of the lake bed in the approach to the stop log structure, and placement of new riprap to protect the structures. The existing aquatic habitat near the Marsh Lake Dam was altered by construction and operation of the dam. The lake bed material is sandy with scattered boulders and riprap along the lake side of the dam.

Based on the construction drawings, the new east embankment for restoring the Pomme de Terre River to its former channel would cover 1.3 acres of floodplain and river channel area. The Pomme de Terre River floodplain has scattered green ash, black willow and cottonwood trees with reed canary grass in the lower areas. The Pomme de Terre River channel is sandy with patches of gravel.

The cut-off dike for re-routing the Pomme de Terre River would cross the Pomme de Terre River floodplain and channel. Based on the construction drawings, the cut-off dike would have a footprint of 0.96 acres.

Replacing the existing culverts under the Louisburg Grade Road with new gated culverts would not change the footprint of the structures. New 1 ft diameter rock riprap would be placed to armor the upstream and downstream ends of the culverts. The area of this fill would total approximately 2800 square feet, or 0.06 acres.

Breaching the dike on the abandoned fish pond would not involve placing fill. Material excavated from the breach area would be removed and placed on an upland site.

Installation of shoreline fishing access structures would affect small areas approximately 20 x 20 ft in the immediate vicinity of the six new structures. The shoreline fishing structures would be located on the shoreline of Marsh Lake adjacent to deeper water suitable for fishing. Most of these structures would be along the already riprapped Marsh Lake Dam.

F. Timing and Duration

Subject to approval and funding, construction could begin in the year 2013. Construction for this project would take 1 to 2 years, depending on when construction is initiated. The culverts on Louisburg Grade Road, the fishway, the fish pond notch, the recreation features and the road raise can be constructed any time during the open water season when water levels allow. The order of construction the diversion dikes and bridge over the Pomme de Terre River along Marsh Lake Dam is important. The bridge should be done first. Then either of the diversion dikes can be constructed next. The cutoff dike that forces the water of the Pomme de Terre River to flow through the bridge needs to be constructed out of impervious fill and needs to be compacted to be stable.

G. Description of the Proposed Borrow Site

The 9.88 acre borrow site is in an agricultural field on the Lac qui Parle Wildlife Management area near the north end of the Marsh Lake Dam (figure 10). Rock would be obtained from local quarries.

H. Description of Material Placement Method

The material would be moved and placed mechanically.

II. FACTUAL DETERMINATIONS

A. Physical Substrate Determinations

Substrate Elevation and Slope - The average annual water level on Marsh Lake is 938.3 ft. The bed of Marsh Lake in the vicinity of the proposed modifications to Marsh Lake Dam is fairly flat and approximately 935.2 ft. The sill elevation of the stop log water control structure would be set at 935.0 ft to enable drawdown of most of the lake. At this sill elevation, no approach channel dredging would be required. Some scour of the lake bed would be expected near the dam when the stop logs are removed.

As the historic Pomme de Terre River channel was originally formed by the geomorphic conditions of the river and its watershed, it is expected that the channel plan form dimensions would result in a stable natural channel once the fine sediments that have accumulated in the former channel are washed out. The reconnection of the Pomme de Terre to its historic channel would require some excavation of material that now blocks this flow path, particularly through the existing embankment and near the mouth where it would meet the Minnesota River. It would also require that fill be placed in two channelized reaches of the current flow path. Some erosion control structures would also be necessary to prevent head cutting. However, the general philosophy would be to connect the river to its original flow path and allow natural processes to form to channel.

Cross section surveys of the Pomme de Terre below Appleton, MN indicate that the average bank full width of channel is approximately 90-110 feet. This width was verified with aerial photos. Steady flow modeling of the Pomme de Terre River with a bankfull discharge (850 cfs) shows that hydraulic depth varies from 3-5 feet in the reach between Appleton and the mouth. An average depth of 4 feet is therefore considered the typical depth for the Pomme de Terre River at bank full flow in the project reach. Based on the stream slope upstream of the project area, a typical slope of 0.0005 ft/ft is considered representative of the reach to be restored.

Sediment Type - Sediment in Marsh Lake is sandy silt. Sediment in the Pomme de Terre River is sandy gravel. Sediment in the former channel of the Pomme de Terre River is approximately six inches of silt and organic matter overlying the former sand and gravel of the river bed.

Dredged/Fill Material Movement – The embankments and cut-off dike to re-route the Pomme de Terre River are designed with riprap armoring to limit erosion by wave action and river current.

B. Water Circulation, Fluctuation, and Salinity Determinations

Water Salinity – Water in the project area has naturally high total dissolved solids, influenced by calcium sulfate in the soils. The fill activities would not affect salinity.

Water Chemistry - The use of clean fill material and mechanical placement would preclude any significant impacts on water chemistry.

Water Clarity - Minor, short-term reductions in water clarity are expected from sediment resuspension associated with the proposed fill activities. Long term, the project is expected to increase water clarity in Marsh Lake.

Water Color - The proposed fill activities should have no impact on water color.

Water Odor – Dense summer blue green algae blooms and windrows of scenescent algae on Marsh Lake produce foul odors and toxicity. The project should reduce foul odors in the summer due to algae blooms.

Water Taste – Marsh Lake and the Pomme de Terre River are not used for water supply.

Dissolved Gas Levels – Modification of the Marsh Lake Dam would allow winter drawdown, intentionally inducing hypoxia (low dissolved oxygen concentration) to kill carp. The project would not otherwise have any effect on dissolved oxygen concentrations.

Nutrients - The proposed fill activities should have no impact on nutrient (nitrogen and phosphorus) concentrations in the water.

Eutrophication - The proposed modifications to Marsh Lake Dam and rerouting the Pomme de Terre River would reduce nutrient loading to Marsh Lake, encourage the growth of aquatic vegetation and reduce the density and duration of blue-green algae blooms.

Temperature - The proposed fill activities would have no impact on water temperature.

Current Patterns and Water Circulation - Re-routing the Pomme de Terre River to its former channel would change the pattern of Pomme de Terre River flow. The river was channelized to enter Marsh Lake above the Marsh Lake Dam when the project was first constructed.

Current Velocity – Modifying the Marsh Lake Dam fixed crest spillway with a fishway would provide a variety of current velocities that would enable upstream fish passage and eliminate the public safety hazard of the hydraulic backroller below the existing spillway.

Restoring the Pomme de Terre River to its former channel would restore a more natural pattern of current velocity in the river.

Stratification – Because Marsh Lake is shallow and thoroughly wind-mixed, the lake does not stratify.

Hydrologic Regime - The proposed fill activities would have no impact on the hydrologic regime of inflows to the project area.

Water Level Fluctuations - Re-routing the Pomme de Terre River to its former channel would change the pattern of Pomme de Terre River flow. The river was channelized to enter Marsh Lake above the Marsh Lake Dam when the project was first constructed. The combined project features would alter the water level regime in Marsh Lake. The overall effect would be increased water level variability, minimal changes during flood events, and occasional managed water level drawdowns.

Salinity Gradient – The project area is not in a coastal estuary.

Actions Taken to Minimize Impact - Standard construction procedures in compliance with Federal and State requirements would be used. The material would be placed mechanically. Silt barriers would be deployed during construction to limit mobilization and transport of sediment in the Pomme de Terre River. Mussels in the Pomme de Terre River have been quantitatively surveyed and recolonization of mussels in the restored channel would be monitored (see Section 4.1.4 in the Feasibility Report).

C. Suspended Particulate/Turbidity Determination - Some temporary and localized increases in suspended sediment would result from construction of the project features.

Restoring the Pomme de Terre River to its former channel would reduce sediment loading to Marsh Lake by about half and improve conditions for growth of submersed aquatic plants. Pomme de Terre River flow at higher levels of river discharge would spread overbank into the vegetated floodplain before reaching the Minnesota River, removing sediment and nutrients before flowing into Lac qui Parle.

Modification of Marsh Lake Dam and restoring a more natural stage hydrograph would allow emergent and submersed aquatic vegetation to expand in Marsh Lake. The vegetation would reduce sediment resuspension and trap suspended sediment resulting in increased water clarity. Winter drawdowns would limit the abundance of common carp that resuspend bottom sediment.

D. Flood Profiles - The changes to large flood levels on Marsh Lake from the proposed project were evaluated with two methods (see Appendix H Hydraulics and Hydrology):

1) For water level simulations over 20 years (1983 – 2003), results for the two largest flood events (1997 & 2001) with & without project features were compared and,

2) Estimated 100 year flood hydrographs for with and without project conditions were routed through the reservoir.

Simulated with project water levels were on the order of 1.5 foot lower than modeled existing conditions for the 1997 & 2001 flood events. This is primarily attributed to reduced inflows to Marsh Lake due to the altered Pomme De Terre flow path.

Marsh Lake is expected to experience lower peak flood elevations due to the project as designed in this feasibility study. Note that the current 100-year Pool Elevation on Marsh Lake of 947.4 feet is above the maximum pool elevation and is not relied upon for flood control downstream.

E. Effects on Chemical and Physical Properties of the Water Column - No effects are expected on light penetration, dissolved oxygen, toxic metals and organisms, pathogens, or the aesthetics of the water column after the project is in place.

F. Aquatic Ecosystem and Organism Determinations:

Effects on Plankton and Fish

Construction of the project features would result in temporary and localized increases in suspended solids that are not expected to adversely affect plankton or fish. Silt curtains will be used where practicable to limit sediment resuspension during construction.

The project is expected to increase water clarity in Marsh Lake, resulting in increased extent and abundance of submersed aquatic plants. Increased water clarity and aquatic plants would improve habitat conditions for native fish, zooplankton and macroinvertebrates.

Modifying the Marsh Lake Dam with a stop log water control structure would allow drawdowns that would reduce the abundance of common carp and favor native fish species.

Restoring the Pomme de Terre River to its former channel would provide fish from Lac qui Parle access to the river for spawning. Construction of a fishway in Marsh Lake Dam would allow northern pike access to high quality spawning habitat in upper Marsh Lake.

Effects on Benthos

Construction of the new embankment to re-route the Pomme de Terre River would bury macroinvertebrates including native mussels and fingernail clams in the Pomme de Terre River (see Section 4.1.4 in the Feasibility Report/EA) where the new embankment crosses the channel. This would affect a 0.18- acre area of river bed. In addition, mussels in the lower reach of the channelized Pomme de Terre River below the new embankment would no longer be in a flowing river and would probably die.

Benthos, primarily chironomid and ceratopogonid midge larvae living in the silt substrate in the former Pomme de Terre River would washed away when the river is diverted back into its former channel. The former channel area would scour down to the historic sand/gravel substrate and would rapidly recolonize with benthic macroinvertebrates from upstream. Native mussels are expected to recolonize the restored river channel.

Effects on Wildlife

The proposed project is expected to increase water clarity in Marsh Lake, resulting in increased extent and abundance of submersed aquatic plants. Increased water clarity and aquatic plants would improve habitat conditions for native fish, muskrats, mink, fish-eating birds like pelicans, herons and egrets, and breeding waterfowl. One of the primary benefits of the project would be increased food (sago pondweed tubers) for fall-migrating waterfowl.

Effects on Aquatic Food Web

The project features in combination and associated management of Marsh Lake water levels are intended to change the ecosystem state of Marsh Lake from a turbid shallow lake with sparse vegetation to a clearer water vegetated condition.

Effects on Special Aquatic Sites

Sanctuaries and Refuges

The project area is within the Lac qui Parle Wildlife Management Area owned and managed by the Minnesota DNR. Parts of Marsh Lake serve as a refuge for migrating waterflowl in the fall. The DNR is the project cost-share partner for this project.

Wetlands, Mud Flats and Vegetated Shallows

Marsh Lake is a shallow lake with an extensive littoral zone. All of Marsh Lake is a wetland area. The project would allow for water level management on Marsh Lake to restore emergent and submersed aquatic vegetation, consolidate sediment, reduce sediment resuspension and reduce abundance of carp. There would be extensive mud flat areas in Marsh Lake in years when it would be drawn down to restore emergent aquatic vegetation. The mud flats would provide excellent habitat for shorebirds.

The Pomme de Terre River floodplain that would be affected by the new embankment and cut-off berm to restore the river to its former channel is also a wetland area.

Natural Floodplain Areas

Restoring the Pomme de Terre River to its former channel would restore floodplain processes in the floodplain at the confluence with the Minnesota River.

Effects on Threatened and Endangered Species

As discussed in the Feasibility Report and EA, no federally-listed threatened or endangered species occur in the project area. The USFWS concurred with this conclusion during the coordination process (Appendix C).

Re-routing the Pomme de Terre River would result in temporary adverse impacts on state-listed mussel species. Native mussels in the Pomme de Terre River are expected to re-colonize the restored river channel and result in a net gain in the abundance and spatial extent of native mussels in the river over time.

G. Contaminant Determinations - The fill material would be clean impervious fill from an upland site and rock and that would not introduce contaminants. Neither the material nor its placement would cause relocation or increases of contaminants in the water.

H. Proposed Disposal Sites Determinations

Mixing Zone Determination - The proposed fill activities would have minimal mixing zones for resuspended sediment. The mixing zones would be small and would not constitute a significant problem because of the nature of the fill material and its placement by mechanical means.

Determination of Compliance with Applicable Water Quality Standards - The nature of the fill material and the type of construction should avoid violation of State water quality standards. The long-term effects of the project would be to increase compliance with state water quality standards in Marsh Lake.

I. Potential Effects on Human Use Characteristics - Because of the present and projected human use characteristics, the existing physical conditions, the proposed construction methods, and the nature of the fill material, this proposed action would have no adverse effects on human use characteristics. The project would improve conditions in the Marsh Lake ecosystem for human uses like hunting, fishing, and wildlife viewing.

J. Determination of Cumulative Effects on the Aquatic Ecosystem - Implementation of the proposed actions would have positive effects of restoring the Marsh Lake and lower Pomme de Terre River aquatic ecosystems.

K. Determination of Secondary Effects on the Aquatic Ecosystem – Secondary effects of the project on the aquatic ecosystem would include increased abundance of emergent and submersed aquatic plants, reduced abundance of common carp, clearer water in Marsh Lake, increased populations of native fish, increased use by breeding waterfowl and migrating waterfowl, and increased recreational use of the area.

III. FINDING OF COMPLIANCE WITH RESTRICTIONS ON DISCHARGE

1. The proposed fill activity would comply with Section 404(b)(1) guidelines of the Clean Water Act of 1972, as amended. No significant adaptations of the guidelines were made for this evaluation. As discussed in the Feasibility Report and Environmental Assessment, the placement of fill for the proposed project is required to achieve the project purpose, which is to benefit the aquatic ecosystem. Therefore, none of the alternatives is environmentally damaging to the aquatic ecosystem.

2. The proposed fill activities would comply with all State water quality standards, Section 307 of the Clean Water Act of 1972, as amended, and the Endangered Species Act of 1973, as amended. The proposed fill activity would not have significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. Aquatic life and other wildlife would not be adversely affected. Significant adverse effects on aquatic ecosystem diversity, productivity, and stability and on recreational, aesthetic, and economic values would not occur.

3. Certification under Section 401 of the Clean Water Act would be obtained from Minnesota prior to implementation.

4. The project would not introduce hazardous or toxic substances into the waters of the United States or result in appreciable increases in existing levels of toxic materials.

5. The project would have no impact on federally listed threatened or endangered species. Re-routing the Pomme de Terre River would result in temporary adverse impacts on state-listed mussel species. Native mussels in the Pomme de Terre River are expected to re-colonize the restored river channel and result in a net gain in the abundance and spatial extent of native mussels in the river over time.

6. No municipal or private water supplies would be affected. The project would have no significant adverse impacts on recreational or commercial fishing. The effect of this project on human uses of the Marsh Lake ecosystem would be positive.

7. No contamination of the Minnesota or Pomme de Terre Rivers is anticipated. The proposed actions would cause only minimal adverse environmental effects during construction and would have positive cumulative effects on the environment.

8. On the basis of this evaluation, I conclude that the proposed discharges would comply with the Section 404(b)(1) Guidelines for the discharge of dredged or fill material.

15 July 2011
Date

Michael J. Price
Colonel, Corps of Engineers
District Engineer

Appendix E – Habitat Evaluation Procedure

Appendix E

Habitat Benefits Evaluation

Marsh Lake Ecosystem Restoration Project

Introduction

An ecosystem restoration measure is a feature or activity that addresses one or more of the planning objectives. A wide variety of alternative measures were considered for March Lake ecosystem restoration project. The Marsh Lake ecosystem restoration alternative measures are described in Section 4 of the main report. The full range of alternative measures is described in Section 4.1. In Section 4.2 of the main report, each measure was assessed and a determination was made regarding whether it should be retained for further consideration in the formulation of alternative plans.

The Corps is required to consider the option of "No Action" as one of the alternatives. With the No Action plan, which is synonymous with the "Future Without Project Condition," we assumed that no project would be implemented by the Federal Government or by local interests to achieve the planning objectives. The No Action plan forms the basis from which the other alternative plans are compared.

Estimated annualized costs of the alternative measures retained for further consideration are provided below are based on March 2010 price levels. They include costs for detailed engineering design, construction and operation and maintenance over the 50-year planning time horizon.

Table 1. Alternative measures retained for further consideration.

Measure Number	Alternative Measures	First Cost of Construction	Interest During Construction	Total Investment	Annualized Cost	Annual O+M Costs	Total Annual Costs
1	No Action	$0	$0	$0	$0	$0	$0
2	Restore Pomme de Terre River to its former channel	$3,741,500	$249,117	$3,990,617	$197,843	$5,622	$203,466
3	Modify Marsh Lake Dam to attain target water levels, construct fishway	$1,217,400	$81,057	$1,298,457	$64,374	$6,207	$70,581
4	Growing season drawdowns to restore emergent aquatic plants, modify Marsh Lake Dam with stoplog structure	$2,605,900	$173,506	$2,779,406	$137,795	$13,926	$151,721
5	Install gated culverts in Louisburg Grade Road	$414,200	$27,578	$441,778	$21,902	$952	$22,854
6	Breach dike at abandoned fish pond	$7,000	$0	$7,000	$347	$0	$347
7	Construct islands in Marsh Lake	$3,946,500	$262,766	$4,209,266	$208,683	$15,190	$223,874

Alternative Plans

Alternative plans are combinations of alternative measures that would contribute to attaining the planning objectives. A stand alone or independent measure can be implemented independently of others, resulting in some positive amount of ecosystem restoration output. Optional or dependent measures are measures that must be implemented along with other measures. Optional measures may be combined with each other as well as with the stand alone measures. Brief descriptions of the measures considered in this study are presented below. More detailed descriptions of the measures are in Section 4.1 of the main report.

Alternative Measures

Measure 1 – No Action

The No Action alternative is a stand-alone measure that could be implemented independently. The Corps is required to consider the option of "No Action" as one of the alternatives. With the No Action plan, which is synonymous with the "Without Project Future Condition," we assume that no project would be implemented by the Federal Government or by local interests to achieve the planning objectives. The No Action plan forms the basis from which the other alternative plans are compared.

Measure 2 – Restore the Pomme de Terre River to its former channel

This is a stand-alone measure that could be implemented independently of other restoration alternatives. Earthen berms would be constructed to re-route the river into its former channel both upstream and downstream of the Marsh Lake Dam embankment. Approximately 11,500 feet and 21 acres of former river channel would be restored. This alternative would include a bridge over the river to maintain access to the Marsh Lake Dam and monitoring of the native mussel community.

Measure 3 - Modify Marsh Lake Dam to attain target water levels, construct fishway

This is a stand-alone measure that could be implemented independently of other restoration alternatives. Marsh Lake Dam would be modified with a fixed-crest weir fishway that would allow passive attainment of target water levels in most years and also allow continuous fish passage between Lac qui Parle and Marsh Lake.

Measure 4 - Growing season drawdowns to restore emergent aquatic plants, reduce carp abundance and modify Marsh Lake Dam with a stoplog structure

This is a stand-alone measure that could be implemented independently of other restoration alternatives. Marsh Lake Dam would be modified with a stop log water control structure to enable water level management. Growing season drawdowns to elevation 936.0 ft would be done to encourage reestablishment of emergent aquatic plants and to increase the extent of submersed aquatic plants. Following growing season drawdowns, winter drawdowns to elevation 935.0 ft could be done to reduce carp abundance. The drawdowns would be conducted as needed to maintain objectives for aquatic vegetation in Marsh Lake. We assume that drawdowns would be done on average once every five years.

Measure 6 – Breach dike at abandoned fish pond

This is a stand-alone measure that could be implemented independently of other restoration alternatives. Breaching the fish pond dike on the downstream side of the Marsh Lake Dam would provide connectivity between the fish pond area and the upper end of Lac qui Parle, allowing native floodplain vegetation to become established, fish access and providing seasonally variable habitat for fish and wading birds.

Measure 7 – Construct islands in Marsh Lake

This is a stand-alone measure that could be implemented independently. Constructing islands to break up wave action and reduce sediment resuspension would improve conditions for submersed aquatic plant growth. Although this is a stand-alone measure, it would be best to construct islands in Marsh Lake in conjunction with growing season and winter drawdowns (Measure 4) and modifying Marsh Lake Dam to attain target water levels (Measure 3). Growing season drawdowns would consolidate lake bed sediment, reducing sediment resuspension. Growing season drawdowns would allow germination of emergent aquatic plants, increasing their extent, reducing wave action and sediment resuspension. Winter drawdowns would reduce carp abundance, sediment resuspension and grazing on submersed aquatic plants. It may require implementation of all these measures in combination to change the ecosystem state of Marsh Lake from the current unvegetated turbid condition to clearer water with submersed aquatic plants.

Optional Measures

Measure 5 – Install gated culverts in Louisburg Grade Road

This is an optional measure because it would not need to be implemented unless Measure 4 was implemented with growing season drawdowns on Marsh Lake. Measure 5 is dependent on implementing Measure 4 and would enhance its performance. Installing stoplog control structures on the Louisburg Grade Road culverts would enable holding water in upper Marsh Lake in years when a growing season drawdown was conducted, allowing northern pike to successfully spawn in the flooded marsh vegetation and the young to grow into juveniles. This measure should be combined with Measure 4.

HEP Analyis of the Alternative Measures

The Marsh Lake project area is described in Section 2.8 of the main report. The alternative measures would affect a variety of habitats in the project area (Table 2). Representative species and guilds of organisms that occur in the Marsh Lake project area were selected for Habitat Evaluation Procedures (HEP) analyses to estimate ecosystem restoration benefits.

The HEP models applied to estimate ecosystem outputs of the Marsh Lake Project are USFWS "Blue Book" models and a waterfowl habitat model developed for use on the Upper Mississippi River System. The Diving Duck Migration Habitat Model is currently undergoing planning model certification with the Corps Ecosystem Restoration

Center of Expertise. The Diving Duck Migration Habitat Model has been used extensively since 1994 to quantify habitat benefits for habitat restoration projects on the Upper Mississippi River. It has stood the test of time and was developed consistent with USFWS's standards for HEP.

Devendorf, R.D. 2001. A migratory habitat model for diving ducks using the Upper Mississippi River. St. Paul District, U.S. Army Corps of Engineers.

Short, H.L and R.J. Cooper. 1985. Habitat suitability index models - Great blue heron FWS/OBS82-10.99.43 pp.

McMahon, T. E., J. W. Terrell, and P. C. Nelson. 1984. Habitat suitability information: Walleye. U.S. Fish and Wildlife Service. FWS/OBS-82/10.56. 43 pp.

Inskip, P.D. 1982. Habitat suitability index models: Northern pike. FWS/OBS-82/10.17. 40 pp.

Table 2. Habitat area types that would be restored by the alternative measures and representative species and guilds used in the habitat benefits analysis.

Alternative Measures	**Habitat Models**	Marsh Lake Aquatic	Pomme de Terre River Aquatic	Upper Marsh Lake Shallow Aquatic	Lac qui Parle Aquatic	Abandoned Fish Pond
1) No Action	Walleye - Lacustrine				+	
	Northern Pike - Lacustrine	+		+	+	
	Diving Ducks	+				
	Great Blue Heron					+
2) Restore Pomme de Terre River to its former channel	Walleye - Lacustrine		+		+	
3) Modify Marsh Lake Dam to attain target water levels, construct fishway	Northern Pike - Lacustrine			+	+	
4) Growing season drawdowns to restore emergent aquatic plants, modify Marsh Lake Dam	Diving Ducks	+				
5) Install gated culverts in Louisburg Grade Road	Northern Pike - Lacustrine	+		+		
6) Breach dike at abandoned fish pond	Great Blue Heron					+
7) Construct islands in Marsh Lake	Diving Ducks	+				

Areas Affected by the Alternative Measures

Each of the alternative measures would affect different areas of habitat (Table3). The habitat areas in Marsh Lake and Lac qui Parle were estimated using the land cover GIS and bathymetry data developed by the DNR. The area of Pomme de Terre River aquatic habitat was estimated by calculating the area in acres using stream length (Marsh Lake to Morris Minnesota Dam) and stream widths from DNR stream survey data. The additional area of the re-routed Pomme de Terre River was estimated using GIS. The area affected by drawdowns and island construction was estimated using GIS using the lake bathymetry map prepared from DNR survey data, and a wind-fetch / wave action / sediment resuspension model described in the Hydraulics Appendix J.

Table 3. Area (acres) of habitat types affected by alternative measures for the Marsh Lake project.

Alternative Measures	Marsh Lake Aquatic Unvegetated	Marsh Lake Aquatic Vegetated	Marsh Lake Emergent Vegetation	Pomme de Terre River Aquatic	Pomme de Terre River Delta Floodplain	Upper Marsh Lake Shallow Aquatic	Lac qui Parle Aquatic	Abandoned Fish Pond
1) No Action	6100	<610	1032	454	293	1,715	7,700	15
2) Restore Pomme de Terre River to its former channel				454	293		7,700	
3) Modify Marsh Lake Dam to attain target water levels, construct fishway	6100	>3050						
4) Growing season drawdowns to restore emergent aquatic plants, modify Marsh Lake Dam			2625					
5) Install gated culverts in Louisburg Grade Road						1,715	7,700	
6) Remove dike at abandoned fish pond								15
7) Construct islands in Marsh Lake	<3050	>3050						

1. Average WSEL of Marsh Lake during growing season: 938.6 ft
2. Area of Marsh Lake at 938.6 ft: 6100 Acres
3. Area of Marsh Lake at 936.0 ft: 3475 acres
4. Area of Marsh Lake dewatered at 936.0 ft: 2625 acres
5. Water Surface Elevation of Marsh Lake during Winter Drawdown: 935.0 ft
6. Area of Marsh Lake during Winter Drawdown 935.0 ft: 2425 acres
7. Area of Marsh Lake upstream of the Louisburg Grade Road (northern pike spawning habitat) = 1,715 acres
8. Area of Pomme de Terre River between Marsh Lake and Marshall Dam = 454 acres
9. Area of Pomme de Terre River channel proposed for restoration = 11,500 lineal feet, 21 acres
10. Area of the Pomme de Terre River delta area below Marsh Lake Dam (between RR grade and the dam) = 293 acres.
11. Area of the abandoned fish rearing pond = 15.6 acres including dike, 15.0 acres within dike

Marsh Lake covers 6100 acres when at the average growing season water level of 938.6 ft. This area is the main part of Marsh Lake between the Louisburg Grade Road and the dam. Upper Marsh Lake upstream of the Louisburg Grade Road is a complex of wetlands that covers 1715 acres.

As of 1999 there were 1032 acres of emergent aquatic vegetation within the 6100 acres in the main part of Marsh Lake. Based on recent aerial photography, the area of emergent aquatic vegetation has not changed since then. The forecasted future without-project extent of emergent aquatic vegetation in Marsh Lake is also 1032 acres.

The existing and forecasted without-project future extent of submersed aquatic vegetation is estimated to be less than 610 acres, approximately 10 percent or less of the lake area. This is based on a 2007 submersed aquatic plant survey that monitored frequency of occurrence of submersed aquatic plants. Frequency of occurrence of sago pondweed was 11 percent (n = 165) but the plants were sparse and found mainly in protected bays and shallow areas.

The following narrative and the Marsh Lake HEP analysis spreadsheets are provided to describe calculation of the habitat benefits of the alternative measures quantified as Average Annual Habitat Units (AAHUs). The AAHUs are habitat suitability indices from the HEP models x acres x years, divided by 50 years, the project planning period.

Alternative Measure 1 – No Action The No Action future condition is described in Section 2.10 in the main report. Five habitat areas were selected for the HEP analysis (Table 2).

Diving ducks were selected as the representative guild for Marsh Lake, given their significance in the project area and the potential for improving fall diving duck migration habitat through restoring aquatic vegetation in Marsh Lake. The analysis area is the main body of Marsh Lake between the dam and the Louisburg Grade Road, a total of 6100 acres.

Table 4. Diving duck migration habitat in Marsh Lake for the No Action future condition.

Diving duck migration habitat

Assume: There would be no change over time in the area of Marsh Lake = 6100 acres average growing season area
There will be no change over time in average annual extent of SAV = <10% cover
Diving duck migration feeding habitat for EAV = ~17% cover
Values of all HSI variables will remain the same over time in the without-project future condition.

Lake Migration Habitat for Diving Ducks	Existing Conditions Year 0	Future Without Project - Year 1	Future Without Project - Year 5	Future Without Project - Year 25	Future Without Project - Year 50
HSI	0.61	0.61	0.61	0.61	0.61
Acreage	6100	6100	6100	6100	6100
Year	0.0	1.0	5.0	25.0	50.0
Cumulative Annual Habitat Units	0	3721.0	14884.0	74420.0	93025.0
				Total	186050.0
				AAHU	3721

Diving duck habitat in Marsh Lake would be limited in the future primarily by the low abundance and diversity of submersed and emergent aquatic vegetation. The current and future habitat suitability index is 0.61. Over the 50-year planning time period, there would be 3721 average annual habitat units (AAHU) of diving duck habitat on Marsh Lake (Tables 4 and 5).

Table 5. HEP model for diving duck habitat in Marsh Lake for the future without-project condition.

DIVING DUCK MIGRATION HABITAT MODEL
MARSH LAKE MINNESOTA RIVER - **WITHOUT-PROJECT FUTURE CONDITIONS**

VARIABLE		VALUE	COMMENTS
1) Size of Water Body			
a. Less than 100 acres	1		
b. 100 to 200 acres	5	ENTER	
c. 200 to 1,000 acres	7	VALUE= 10	Marsh Lake is >1000 acres
d. Greater than 1,000 acres	10		
2) Water Depth - Percent of Area 18" to 5'			
a. Less than 10 percent	1		
b. 10 to 40 percent	3	ENTER	
c. 40 to 70 percent	5	VALUE= 10	
d. Greater than 70 percent	10		Water depth is >70% area 18" to 5'
3) Percent Submergent Vegetation Cover			
a. Less than 10 percent	1		
b. 10 to 30 percent	3	ENTER	
c. 30 to 50 percent	6	VALUE= 1	Extent of SAV cover <10%
d. Greater than 50 percent	10		
4) Species of Submergent Vegetation Present (Key species: wild celery, sago pondweed, and other pondweeds)			
a. None of the key species present or less than 10 percent of aquatic bed	1		
b. At least one key species covers 10 to 30 percent of the aqutaic bed (add one point if more than one key species is present)	3	ENTER VALUE= 10	SAV is mostly sago pondweed
c. At least one key species covers 30 to 60 percent of the aquatic bed (add one point if more than one key species is present)	6		
d. Greater than 60 percent of aquatic bed is comprised of key food species	10		
5) Percent Emergent Vegetation Cover			
a. Less than 10 Percent or greater than 50 percent	1		Approximately 17% EAV cover
b. 10 to 20 percent or 30 to 50 percent	5	ENTER	
c. 20 to 30 percent	10	VALUE= 5	
6) Species of Emergent Vegetation Present (Key species: arrowhead (S. rigida), soft-stem bulrush, wild rice)			
a. None of the key species present or less than 10 percent fo aquatic bed	1		
b. At least one key species covers 10 to 30 percent of the aqutaic bed (add one point if more than one key species is present)	3	ENTER VALUE= 1	EAV will remain mostly cattail
c. At least one key species covers 30 to 60 percent of the aqutaic bed (add one point if more than one key species is present)	6		
d. Greater than 60 percent of aquatic bed is comprised of key food species	10		
7) Invertebrate Populations Present (Key Species: Sphaeriidae, Gastropoda,Hexegenia spp,Chironomidae)			
a. None of the key taxonomic groups present or present but not abundant	1		
b. At least 1 key taxonomic group present and is moderately abundant	5	ENTER VALUE= 5	dominated by chironomids, oligochaetes
c. At least 1 key taxonomic group present and is very abundant	10		
8) Disturbance			
a. Access uncontrolled - Considerable human activity during migration	1		
b. No hunting activity occurs, or closed to hunting only, but considerable human activity occurs during migration (such as fishing/boating)	3	ENTER VALUE= 4	Assume continued non-motorized zone
c. No hunting activity occurs, or closed to hunting only, and human activity during migration is minimal	4		
d. No human activity occurs, or closed to human entry	5		
		TOTAL= 46	
MAXIMUM POSSIBLE TOTAL =		75	
		HSI = 0.61	

The primary sport fish species in the project area and the selected fish species for aquatic habitat analysis are walleye and northern pike. Walleye occur in Lac qui Parle and in the Pomme de Terre River. Habitat for walleye in Marsh Lake is marginal due to the shallow depth, turbid conditions and winter hypoxia. According to the DNR, walleye are recruited into Lac qui Parle from Bigstone Lake upstream on the Minnesota River and by stocking walleye fry. Walleye rarely naturally reproduce in Lac qui Parle. Walleye occur in the Pomme de Terre River and there is evidence that they naturally reproduce there by the presence of young-of-year walleye. There is good water quality and an abundance of suitable walleye habitat in the Pomme de Terre River. Walleye in Lac qui Parle will be limited in the future by their ability to repro(duce given the habitat conditions available. The future habitat suitability index is 0.2 resulting in an AAHU of 1540 over the 50-year project planning period (Tables 6 and 7).

Table 6. Walleye habitat in Lac qui Parle for the without-project future condition.

Walleye habitat - Lac qui Parle

Assume : Lac qui Parle covers 7700 acres
Walleye from Lac qui Parle cannot get into Marsh Lake and up the Pomme de Terre River in most years
Walleye rarely successfully reproduce in Lac qui Parle. Last strong recruitment was in 2001
Walleye in Lac qui Parle are stocked and recruited from Bigstone Lake
Values of all HSI variables will remain the same over time in the without-project future condition.
Walleye habitat evaluated for Lac qui Parle without-project future conditions

Habitat for Walleye in Lac qui Parle	Existing Conditions Year 0	Future Without Project - Year 1	Future Without Project - Year 5	Future Without Project - Year 25	Future Without Project - Year 50
HSI	0.2	0.2	0.2	0.2	0.2
Acreage	7700.0	7700.0	7700.0	7700.0	7700.0
Year	0.0	1.0	5.0	25.0	50.0
Cumulative Annual Habitat Units	0	1540.0	6160.0	30800.0	38500.0
				Total	77000.0
				AAHU	1540

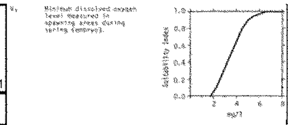
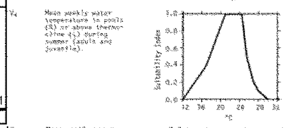
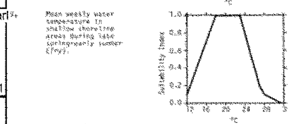
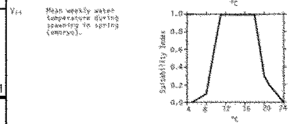
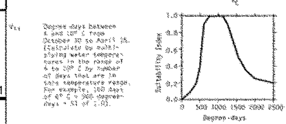
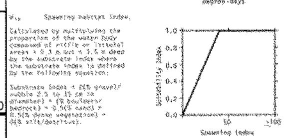
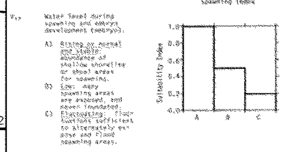
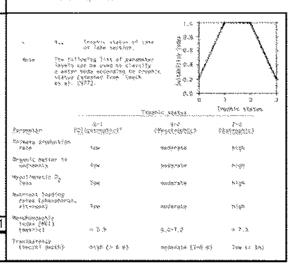
Table 7. HEP model of walleye habitat in Lac qui Parle for the without-project future condition.

Walleye Lacustrine Habitat Model
Without-Project Future Conditions

Assume . Walleye occur in Marsh Lake and in Lac qui Parle
Marsh Lake habitat is marginal for walleye due to turbidity and shallow depth
Assessed walleye habitat is in Lac qui Parle
Walleye from Lac qui Parle cannot get into Marsh Lake and up the Pomme de Terre River in most years
Walleye rarely successfully reproduce in Lac qui Parle. Last strong recruitment was in 2001
Walleye in Lac qui Parle are stocked or recruited from Marsh and Bigstone Lake

V1	Average Secchi transparency during summer Average Secchi transparency in Lac qui Parle in summer is 1.7 ft (MN DNR lake survey report) Note: Low transparency in LqP does not impose limitation on walleye, which exhibit fast growth	0.2
V2	Relative abundance of small (<12 cm) forage fish during spring and summer Assume abundant forage fish - fathead minnows, spotfin minnows, emerald shiners, white suckers	1
V3	Percent of area with cover (boulders, logs, brush, SAV) and D.O. >3 mg/l in spring and summer Some boulders, adequate D.O. Note: Cover does not impose limitation on walleye in LqP which exhibit fast growth	0.2
V4	Least suitable pH during year Lac qui Parle maximum pH is ~8.7 (Corps data)	1
V5	Minimum D.O.above thermocline in summer D.O. is adequate according to Corps data	1
V6	Minimum D.O. during summer-fall in shallow shoreline areas D.O. is adequate according to Corps data	1

Table 7 (continued). HEP model of walleye habitat in Lac qui Parle for the without-project future condition.

V7 Minimum D.O. in spawning areas in spring D.O. is adequate in spring Note: Walleye reproduction rarely occurs in Lac qui Parle Probably a combination of water level and substrate limitations	1	
V8 Mean weekly water temperature above thermocline during summer Temperature is adequate according to Corps data	1	
V9 Mean weely water temperature in shallow shoreline areas during late spring, earl D.O. is adequate according to Corps data	1	
V10 Mean weekly water temperature during spawning in spring D.O. is adequate according to Corps data Note: Walleye reproduction rarely occurs in Lac qui Parle Probably a combination of water level and substrate limitations	1	
V11 Degree days between 4 and 10C October 30 to April 16 ok according to Corps data	1	
V12 Spawning habitat index Highly variable depending on water level Portion of LqP littoral area >0.3m but <1.5m = 0.1 Subatrate index = 2 (5% gravel, rubble) + (3% boulders) + 0.5 (10% sand) + 0 (85% silt) = 18 Spawning habitat index = 0.1 x 18 = 1.8	0	
V13 Water level during spawning Highly variable. Often flooding during walleye spawning	0.2	
V14 Trophic status of lake Lac qui Parle is eutrophic Lac qui Parle supports a popular walleye fishery, so the eutrophic conditions (low water transparency, blue-green algae) may not limit the walleye population	1	

Component Suitability Indices Lacustrine Model

Food = (V1+V2)/2	0.6
Cover = (3V1 + V3)/4	0.2
Water Quality = lowest of V4,V5,V6,V8,V9	1.0
Reproduction = lowest of V7, V10, V11, V12, V13	0.2
Other = V14	1.0

Lowest Component Value = Overall Habitat Suitability 0.2

Note: Food (V1, V2) and cover (V1, V3) are not limiting the walleye population in Lac qui Parle. Reproduction imposes limitation on walleye in LqP

Northern pike occur in Marsh Lake and in Lac qui Parle. Northern pike spawn in the upper end of Marsh Lake upstream of the Louisburg Grade Road. Northern pike in Marsh Lake have access to upper Marsh Lake and good flooded vegetation habitat for spawning and early life history. The habitat suitability index for northern pike in the future in Marsh Lake is 0.8, resulting in 4880 AAHUs. Northern pike in Lac qui Parle would not have access to as much suitable spawning habitat, resulting in a future habitat suitability index of 0.6 and 4620 AAHUs (Tables 8, 9 and 10).

Table 8. Northern pike habitat in Marsh Lake and Lac qui Parle for the without-project future condition.

Northern pike habitat - Marsh Lake

Assume : There would be no change in the area of upper Marsh Lake = 1715 acres
There would be no change in the area of Marsh Lake = 6100 acres
Northern pike would have unobstructed access to upper Marsh Lake for spawning
Values of all HSI variables will remain the same over time in the without-project future condition.

Northern Pike Habitat - Marsh Lake	Existing Conditions Year 0	Future Without Project - Year 1	Future Without Project - Year 5	Future Without Project - Year 25	Future Without Project - Year 50
HSI	0.8	0.8	0.8	0.8	0.8
Acreage	6100.0	6100.0	6100.0	6100.0	6100.0
Year	0.0	1.0	5.0	25.0	50.0
Cumulative Annual Habitat Units	0	4880.0	19520.0	97600.0	122000.0
				Total	244000.0
				AAHU	4880

Northern pike habitat - Lac qui Parle

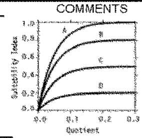
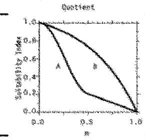
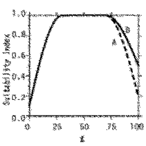
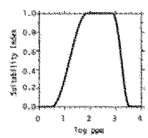
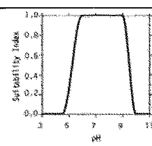
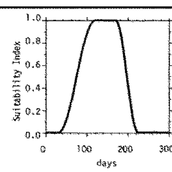
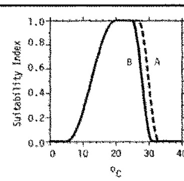
Assume : There would be no change in the area of Lac qui Parle = 7700 acres
Northern pike would not access to upper Marsh Lake for spawning, would spawn in former Pomme de Terre River delta area
Values of all HSI variables will remain the same over time in the without-project future condition.

Northern Pike Habitat - Marsh Lake	Existing Conditions Year 0	Future Without Project - Year 1	Future Without Project - Year 5	Future Without Project - Year 25	Future Without Project - Year 50
HSI	0.6	0.6	0.6	0.6	0.6
Acreage	7700.0	7700.0	7700.0	7700.0	7700.0
Year	0.0	1.0	5.0	25.0	50.0
Cumulative Annual Habitat Units	0	4620.0	18480.0	92400.0	115500.0
				Total	231000.0
				AAHU	4620

Table 10. HEP model of northern pike habitat in Marsh Lake for the without-project future condition.

Northern Pike Model (Lacustrine) Marsh Lake
Without-Project Future Conditions

Assume **:** Northern pike occur in Marsh Lake, spawn in flooded vegetation in upper Marsh Lake

	VARIABLE	VALUE	COMMENTS
V1	Ratio of spawning habitat area to midsummer habitat area Upper Marsh Lake = 1715 acres Marsh Lake = 6100 acres Ratio = 0.28, curve A = good vegetation	1.0	
V2	Drop in water level during embryo (A) and fry (b) stage, whichever is lowest Typically, Marsh Lake water levels during northern pike spawning are high and remain high for weeks	0.8	
V3	Percent of midsummer area with SAV or EAV Marsh Lake EAV area = 1032 acres Marsh Lake SAV area = ~10% of 6100 acres = 610 26.9	1.0	
V4	Log10 summer TDS Mean Marsh Lake summer TDS = 675 mg/l Log10 of 675 = 2.829304	1.0	
V5	Least suitable pH during embyro and fry stages pH is ok - Corps data	1.0	
V6	Average length of frost-free season 135 days average at Milan MN R.H. Skaggs and D.G. Baker 1985 Fluctuations in the length of the growing season in Minnesota Climate Change http://www.springerlink.com/content/g65g3wl9k074w840/	1	
V7	Maximal weekly water temperature in summer A = unstratified lake 28C Corps data	0.8	

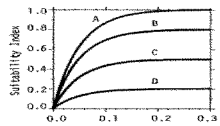
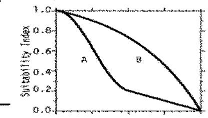
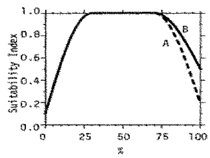
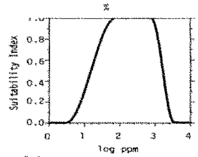
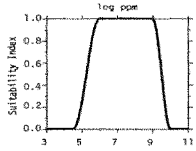
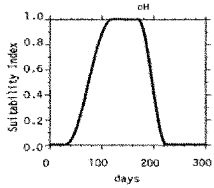
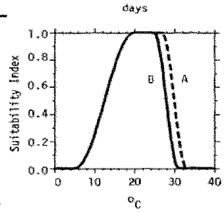
Habitat Suitability Index = lowest of the habitat suitability ratings 0.8

Table 11. HEP model for northern pike habitat in Lac qui Parle for the without-project future condition.

Northern Pike Model (Lacustrine) Lac qui Parle

Without-Project Future Conditions

Assume : Northern pike spawn in the former Pomme de Terre River delta area in upper Lac qui Parle

	VARIABLE	VALUE	HABITAT SUITABLITY
V1	Ratio of spawning habitat area to midsummer habitat area Former PdT River delta = 293 acres Lac qui Parle = 7700 acres Ratio = 0.038, curve A = good vegetation	0.6	
V2	Drop in water level during embryo (A) and fry (b) stage, whichever is lowest Typically, Lac qui Parle water levels during northern pike spawning are high and remain high for weeks	0.8	
V3	Percent of midsummer area with SAV or EAV Lac qui Parle EAV area assumed to be ~1000 acres Lac qui Parle SAV area = ~5% of 7700 acres = 385 acres 17.8 %	0.6	
V4	Log10 summer TDS Lac qui Parle summer TDS = ~ 675 mg/l Log10 of 675 = 2.829304	1.0	
V5	Least suitable pH during embyro and fry stages pH is ok - Corps data	1.0	
V6	Average length of frost-free season 135 days average at Milan MN R.H. Skaggs and D.G. Baker 1985 Fluctuations in the length of the growing season in Minnesota Climate Change http://www.springerlink.com/content/g65g3wl9k074w840/	1	
V7	Maximal weekly water temperature in summer A = unstratified lake 28C Corps data	0.8	

Habitat Suitability Index = lowest of the habitat suitability ratings 0.6

Great blue heron was selected as the representative species for the abandoned fish pond area downstream of the Marsh Lake Dam. The fish pond area has potential to be restored to be a connected shallow marsh and aquatic habitat more suitable for fish-eating birds like great blue heron. The abandoned fish pond area covers 15 acres. Future habitat suitability index would be 0.31, providing 5 AAHUs (Tables 12 and 13). Foraging habitat quality is the primary factor limiting great blue heron habitat in the abandoned and isolated fish pond area.

Table 12. Blue heron habitat in the abandoned fish pond area adjacent to Marsh Lake Dam for the without-project future condition.

Great Blue Heron Habitat - Abandoned Fish Pond Area

Assume: Values of all HSI variables will remain the same over time in the without-project future condition.
Area of abandoned fish pond = 15 acres

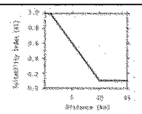
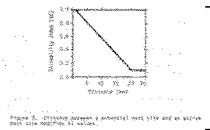
Wetland Habitat for Great blue heron in 500 ft wide band	Existing Condition Year 0	Future Without Project - Year 1	Future Without Project - Year 5	Future Without Project - Year 25	Future Without Project - Year 50
HSI	0.31	0.31	0.31	0.31	0.31
Acreage	15.0	15.0	15.0	15.0	15.0
Year	0.0	1.0	5.0	25.0	50.0
Cumulative Annual Habitat Units	0.0	4.6	18.6	93.0	116.2
				Total	232.4
				AAHU	5

Table 13. HEP model of great blue heron habitat in the abandoned fish pond area for the without-project future condition.

Great Blue Heron Model
Without-Project Future Conditions

Assume :
Heron foraging area in abandoned fish pond
Heron nesting areas are available in wooded floodplain nearby

V1 distance between foraging and nesting areas SI = 1.0
V2 foraging areas quality SI = 0.5
V3 disturbance in foraging areas SI = 1.0
V4 nesting trees SI = 1.0
V5 disturbance during nesting SI = 0.9
V6 distance between potential and active nest sites (<2km) SI = 1.0
HSI = (V1 x V2 x V3 x V4 x V5 x V6) exp 0.5 = 0.67

	VARIABLE	VALUE	HABITAT SUITABILITY
V1	Distance between foraging areas and existing or potential heronries Assumed to be close < 5 km	0.6	
V2	Foraging area quality Heron foraging area in abandonded fish pond is marginal habitat for blue herons with no flow through, limited small fish abundance	0.2	V2 = 1.0 if potential foraging habitats usually have shallow, clear water with a firm substrate and a huntable population of small fish. V2 = 0.0 if potential foraging habitats usually do not provide the desirable combination of conditions.
V3	Disturbance in foraging areas Little human disturbance	1	V3 = 1.0 if there usually is no human disturbance near the potential foraging zone during the 4 hours following sunrise or preceding sunset or the foraging zone is generally about 100 m from human activities and habitation or about 50 m from roads with occasional, slow-moving traffic. V3 = 0.0 if the above conditions are not usually met.
V4	Potential nesting areas Assume potential nesting areas are available and suitable	1	Variable 4 (V4) in the model defines a potential nest site as a grove of trees at least 0.4 ha in area located over water or within 250 m of water. These potential nest sites may be on an island within a river or lake, within a woodland dominated swamp, or in vegetation near a river or lake. Trees used as nest sites are at least 5 m high and have many branches at least 2.5 cm in diameter that are capable of supporting nests. Trees may be alive or dead but must have an "open canopy" that allows an easy access to the nest. V4 = 1.0 if potential treeland habitats usually fulfill all of these conditions. V4 = 0.0 if potential treeland habitats usually do not fulfill all of these conditions.
V5	Disturbance in nesting areas Assume nesting areas receive little human disturbance	1	V5 = 1.0 if the exclusion zone is usually free from human disturbances during the nesting season. V5 = 0.0 if the exclusion zone is usually not free from human disturbance during the nesting season.
V6	Distance between potential and active nest sites Assume distance is < 5 km	0.8	

HSI = (V1 x V2 x V3 x V4 x V5 x V6) exp 0.5
HSI = (0.6 x 0.2 x 1 x 1 x 1 x 0.8) exp 0.5   0.31

<u>Alternative Measure 2 – Restoring the Pomme de Terre River to its Former Channel</u> would provide fish in Lac qui Parle access to approximately 454 acres of high quality Pomme de Terre River habitat in the 52 miles of river between Lac qui Parle and the dam at Marshall, Minnesota. Restoring the Pomme de Terre River to its former channel would also restore 11,500 lineal feet and 21 acres of former river channel habitat between Marsh Lake Dam and the Minnesota River in the upper end of Lac qui Parle. Walleye were selected as the representative species for the habitat benefits analysis for this alternative measure. Lac qui Parle covers 7,700 acres at the average annual water level. The limitation of spawning habitat suitability would be removed in that walleye would have access to high quality spawning habitat in the Pomme de Terre River. Future average annual habitat units would be 8107, resulting in a net gain over the without project condition of 6567 AAHUs (Tables 14 and 15).

Table 14. Walleye habitat in Lac qui Parle with the Pomme de Terre River restored to its former channel.

Walleye Habitat - Lac qui Parle and Pomme de Terre River

Assume : Walleye occur in Lac qui Parle
Marsh Lake habitat is marginal for walleye due to turbidity and shallow depth
Walleye from Lac qui Parle will be able to migrate between Lac qui Parle and the Pomme de Terre River
Walleye rarely successfully reproduce in Lac qui Parle. Last strong recruitment was in 2001
Walleye successfully reproduce in the Pomme de Terre River as evidenced by presence of YOY
Walleye in Lac qui Parle are stocked and recruited from Marsh and Bigstone Lake
Restoration benefits to walleye will be in Pomme de Terre River and in Lac qui Parle
Lac qui Parle area = 7700 acres, Pomme de Terre River to Morris = 454 acres
Restored Pomme de Terre River channel = 21 acres

Habitat for Walleye	Existing Conditions Year 0	Future With Project - Year 1	Future With Project - Year 5	Future With Project - Year 25	Future With Project - Year 50
HSI	0.2	1	1	1	1
Acreage	7700	8175	8175	8175	8175
Year	0	1	5	25	50
Cumulative Annual Habitat Units	0	4794	32700	163500	204375
				Total	405369
				AAHU	8107

Alternative 2 Total AAHU	8107
Minus No Action for Walleye	1540
Alternative 2 Net Gain AAHU	6567

Table 15. HEP model of walleye habitat in Lac qui Parle with the Pomme de Terre River restored to its former channel.

Walleye Lacustrine and Riverine Habitat Model
With-Project Future Conditions - Pomme de Terre River restored to its former channel

Assume : Marsh Lake habitat is very marginal for walleye due to turbidity, winter hypoxia and shallow depth
Walleye occur in Lac qui Parle
Walleye in Lac qui Parle are stocked or recruited from Marsh and Bigstone Lake
Walleye rarely successfully reproduce in Lac qui Parle. Last strong recruitment was in 2001
Walleyes will be able to move freely between the Pomme de Terre River and Lac qui Parle
Walleye successfully reproduce in the Pomme de Terre River as evidenced by presence of YOY
Benefits to walleye will be in Pomme de Terre River and Lac qui Parle

VARIABLE	VALUE	COMMENTS
V1 Average Secchi transparency during summer Assume average 2 - 3 ft Secchi transparency, based on stream survey data	1	Variable V_1 Average transparency (Secchi depth) durin summer.
V2 Relative abundance of small (<12 cm) forage fish during spring and summer Assume abundant forage fish - fathead minnows, spotfin minnows, emerald shiners, white suckers	1	V_2 Relative abundance o small (< 12 cm) fora fishes during spring and summer (fry, juvenile, and adult) Note: SI for this variable f predicted or future co ditions can be based o standing crop predicti models, such as those presented by Aggus and Morais (1979).
V3 Percent of area with cover (boulders, logs, brush, SAV) and D.O. >3 mg/l in spring and summer The Pomme de Terre River has good cover and D.O. based on stream survey data	1	V_3 Percent of water bod with cover (boulders log piles, brush, submerged vegetation and adequate dissolv oxygen (> 3 mg/l) du the spring and summe (fry, juvenile, and
V4 Least suitable pH during year pH 7.9 based on stream survey data	1	V_4 Least suitable pH during the year.
V5 Minimum D.O. in pools and runs in summer D.O. is adequate based on stream survey data	1	V_5 Minimum dissolved o level in pools and (R) or above thermo (L) in summer (adul juvenile).
V6 Minimum D.O. during summer-fall in shallow shoreline areas D.O. is adequate based on stream survey data	1	

Table 15 (continued). HEP model of walleye habitat in Lac qui Parle with the Pomme de Terre River restored to its former channel.

V7	Minimum D.O. in spawning areas in spring D.O. is adequate based on stream survey data	1
V8	Mean weekly D.O. in pools during summer D.O. is adequate based on stream survey data	1
V9	Mean weely water temperature in shallow shoreline areas during late spring, early summer Water temperature ok based on stream survey data	1
V10	Mean weekly water temperature during spawning in spring Water temperature presumed to be ok	1
V11	Degree days between 4 and 10C October 30 to April 16 Don't have data to calculate, presumed to be OK	1
V12	Spawning habitat index Abundant suitable spawning habitat	1
V13	Water level during spawning Variable but good. Upstream lakes and wetlands maintain spring flow.	1
V14	Trophic status of lake Lac qui Parle is eutrophic Lac qui Parle supports a popular walleye fishery, so the eutrophic conditions (low water transparency, blue-green algae) may not limit the walleye population	1

Component Suitability Indices Lacustrine/Riverine Model

Food = (V1+V2)/2	1.0
Cover = (3V1 + V3)/4	1.0
Water Quality = lowest of V4,V5,V6,V8,V9	1.0
Reproduction = lowest of V7, V10, V11, V12, V13	1.0
Other = V14	1.0
Lowest Component Value = Overall Habitat Suitability	1.0

V6 Minimum dissolved o level during summer along shallow shore areas (fry).

V7 Minimum dissolved o level measured in spawning areas duri spring (embryo).

V8 Mean weekly water temperature in pool (R) or above therm cline (L) during summer (adult and juvenile).

V9 Mean weekly water temperature in shallow shoreline areas during late spring-early summe (fry).

V10 Mean weekly water temperature during spawning in spring (embryo).

V11 Degree days between 4 and 10° C from October 30 to April (Calculate by multi plying water temper tures in the range 4 to 10° C by numbe of days that are in this temperature ra For example, 160 da of 6° C = 960 degre days = SI of 1.0).

V12 Spawning habitat in

Calculated by multiplying th proportion of the water body composed of riffle or litton areas > 0.3 m but < 1.5 m de by the substrate index where the substrate index is defin by the following equation:

Substrate Index = 2(% gravel rubble 2.5 to 15 cm in diameter) + (% boulders/ bedrock) + 0.5(% sand) + 0.5(% dense vegetation) + 0(% silt/detritus).

V13 Water level during spawning and embryo development (embryo

A) Rising or norma and stable; abundance of shallow shoreli or shoal areas for spawning.
B) Low; many spawning areas are exposed, an never inundated

Restoring the Pomme de Terre River to its former channel would provide additional benefits by restoring river channel and floodplain structure, function and processes. The restored 21 acres of river channel would positively affect 292 acres of floodplain habitat in the upper end of Lac qui Parle. Additional benefits would accrue to floodplain vegetation, wading birds like great blue heron, to resident fish, macroinvertebrates and to freshwater mussels.

Alternative Measure 3 – Modifying Marsh Lake Dam to passively attain target water levels by constructing a fishway would be primarily done to attain Objective 4a to restore a more natural hydrologic regime, in order to attain Objective 7b, increased submersed aquatic plants in Marsh Lake and Objective 8A, increased waterfowl use on Marsh Lake. Diving ducks were selected as the representative guild for the habitat analysis benefits for this alternative measure. Marsh Lake covers 6100 acres at the average annual water level. Modifying the Marsh Lake Dam with a fishway would provide passive water level management with somewhat lower water levels in late summer, but the average annual water level and lake acreage would remain the same.

This measure would increase the extent of submersed and emergent aquatic vegetation but significant inter-annual variation in the extent of submersed aquatic vegetation would occur. Sediment loading from the Pomme de Terre River, wind-driven sediment resuspension, sediment resuspension and grazing by carp would combine to limit submersed aquatic vegetation under this stand-alone alternative to an estimated three years out of ten of abundant SAV. The Alternative Measure 2 net gain would be 483 AAHUs (Tables 18 and 19).

Modifying Marsh Lake Dam spillway with a fishway would also provide benefits to fish in Lac qui Parle. Northern pike from Lac qui Parle could gain access to prime spawning habitat in the upper end of Marsh Lake.

Table 18. Diving duck habitat in Marsh Lake with dam modification with fishway to achieve target water levels.

Diving duck migration habitat

Assume : There would be no change over time in the area of Marsh Lake = 6100 acres average growing season area
Habitat value will increase by year 2

Lake Migration Habitat for Diving Ducks	Existing Conditions Year 0	Future With Project - Year 1	Future With Project - Year 5	Future With Project - Year 25	Future With Project - Year 50
HSI	0.61	0.69	0.69	0.69	0.69
Acreage	6100.0	6100.0	6100.0	6100.0	6100.0
Year	0.0	1.0	5.0	25.0	50.0
Cumulative Annual Habitat Units	0	3965.0	16836.0	84180.0	105225.0
				Total	210206.0
				AAHU	4204

Alternative 3 Total AAHU	4204
Minus No Action for diving ducks	3721
Alternative 3 Net Gain AAHU	483

Table 19. HEP model of diving duck habitat in Marsh Lake with dam modification with fishway to achieve target water levels.

DIVING DUCK MIGRATION HABITAT MODEL
MARSH LAKE MINNESOTA RIVER - **WITH-PROJECT FUTURE CONDITIONS**
ALTERNATIVE MEASURE 3 DAM MODIFICATION WITH FISHWAY TO ACHIEVE TARGET WATER LEVELS

VARIABLE		VALUE	COMMENTS
1) Size of Water Body			
a. Less than 100 acres	1		
b. 100 to 200 acres	5	ENTER	
c. 200 to 1,000 acres	7	VALUE= 10	
d. Greater than 1,000 acres	10		
2) Water Depth - Percent of Area 18" to 5'			
a. Less than 10 percent	1		
b. 10 to 40 percent	3	ENTER	
c. 40 to 70 percent	5	VALUE= 10	
d. Greater than 70 percent	10		
3) Percent Submergent Vegetation Cover			
a. Less than 10 percent	1		Target water levels would allow SAV to grow to 30 to 50% cover 3 out of 10 years on average, limited by sediment resuspension and carp grazing
b. 10 to 30 percent	3	ENTER	
c. 30 to 50 percent	6	VALUE= 2	
d. Greater than 50 percent	10		
4) Species of Submergent Vegetation Present (Key species: wild celery, sago pondweed, and other pondweeds)			
a. None of the key species present or less than 10 percent of aquatic bed	1		
b. At least one key species covers 10 to 30 percent of the aqutaic bed (add one point if more than one key species is present)	3	ENTER VALUE= 10	Assume SAV is mostly sago pondweed
c. At least one key species covers 30 to 60 percent of the aquatic bed (add one point if more than one key species is present)	6		
d. Greater than 60 percent of aquatic bed is comprised of key food species	10		
5) Percent Emergent Vegetation Cover			
a. Less than 10 Percent or greater than 50 percent	1		
b. 10 to 20 percent or 30 to 50 percent	5	ENTER	
c. 20 to 30 percent	10	VALUE= 10	Assume dam modifications will increase extent of EAV to >20%
6) Species of Emergent Vegetation Present (Key species: arrowhead (S. rigida), soft-stem bulrush, wild rice)			
a. None of the key species present or less than 10 percent fo aquatic bed	1		
b. At least one key species covers 10 to 30 percent of the aqutaic bed (add one point if more than one key species is present)	3	ENTER VALUE= 1	Assume EAV will remain mostly cattail
c. At least one key species covers 30 to 60 percent of the aqutaic bed (add one point if more than one key species is present)	6		
d. Greater than 60 percent of aquatic bed is comprised of key food species	10		
7) Invertebrate Populations Present (Key Species: Sphaeriidae, Gastropoda,Hexegenia spp,Chironomidae)			
a. None of the key taxonomic groups present or present but not abundant	1		
b. At least 1 key taxonomic group present and is moderately abundant	5	ENTER VALUE= 5	Assume invert community will remain dominated by chironomids, oligochaetes
c. At least 1 key taxonomic group present and is very abundant	10		
8) Disturbance			
a. Access uncontrolled - Considerable human activity during migration	1		
b. No hunting activity occurs, or closed to hunting only, but considerable human activity occurs during migration (such as fishing/boating)	3	ENTER VALUE= 4	Assume continued non-motorized zone
c. No hunting activity occurs, or closed to hunting only, and human activity during migration is minimal	4		
d. No human activity occurs, or closed to human entry	5		

TOTAL= 52

MAXIMUM POSSIBLE TOTAL = 75

HSI = 0.69

Alternative Measure 4 - Growing season drawdowns to restore emergent aquatic plants by modifying Marsh Lake Dam with a stop log structure would enable active water level management to restore a more natural stage hydrograph on Marsh Lake. This measure would provide the Lac qui Parle Wildlife Management Area managers considerable flexibility to positively affect the ecosystem conditions in Marsh Lake. Growing season drawdowns could be conducted to reestablish emergent aquatic plants, followed by winter drawdown to kill carp that feed on submersed aquatic plants. This measure would result in increased extent of emergent aquatic plants by exposing lake bottom and consolidating sediment, allowing EAV to germinate from seed and persist for a number of years before another drawdown is needed.

This stand-alone measure would increase the extent of submersed aquatic vegetation but significant inter-annual variation in the extent of submersed aquatic vegetation would occur. Sediment loading from the Pomme de Terre River and wind-driven sediment resuspension would combine to limit submersed aquatic vegetation under this stand-alone alternative to an estimated three years out of ten of abundant SAV. This measure would result in a net gain of 725 AAHUs for diving ducks (Tables 20 and 21).

In addition to improving habitat for diving ducks, drawdowns would contribute to maintaining a vegetated and clear-water ecosystem state. Drawdowns would improve habitat conditions for dabbling ducks and marsh birds like yellow-headed blackbird and wading birds like herons and bitterns. Increased emergent vegetation would benefit furbearers like muskrat and mink. The winter drawdowns would suppress carp abundance, reducing sediment resuspension and grazing by carp.

Table 20. Diving duck habitat in Marsh Lake with drawdowns to restore aquatic vegetation.

Diving duck migration habitat

Assume : There would be no change in the area of Marsh Lake = 6100 acres average growing season area
Growing season drawdowns would dewater up to 2625 acres, increase extent of EAV and SAV
SAV would increase after first year of drawdown
Additional future drawdowns would be conducted to maintain the extent of SAV
Average annual extent of SAV will increase to >50% cover by year 2

Lake Migration Habitat for Diving Ducks	Existing Conditions Year 0	Future With Project - Year 1	Future With Project - Year 5	Future With Project - Year 25	Future With Project - Year 50
HSI	0.61	0.73	0.73	0.73	0.73
Acreage	6100.0	6100.0	6100.0	6100.0	6100.0
Year	0.0	1.0	5.0	25.0	50.0
Cumulative Annual Habitat Units	0	4087.0	17812.0	89060.0	111325.0
				Total	222284.0
				AAHU	4446

Alternative 4 Total AAHU	4446
Minus No Action for Diving Ducks	3721
Alternative 4 Net Gain AAHU	725

Table 21. HEP model of diving duck habitat in Marsh Lake with drawdowns to restore aquatic vegetation.

DIVING DUCK MIGRATION HABITAT MODEL
MARSH LAKE MINNESOTA RIVER - MEASURE 4 WITH-DRAWDOWNS FUTURE CONDITIONS

VARIABLE		VALUE	COMMENTS
1) Size of Water Body			
a. Less than 100 acres	1		
b. 100 to 200 acres	5	ENTER	
c. 200 to 1,000 acres	7	VALUE= 10	Marsh Lake is >1000 acres
d. Greater than 1,000 acres	10		
2) Water Depth - Percent of Area 18" to 5'			
a. Less than 10 percent	1		
b. 10 to 40 percent	3	ENTER	
c. 40 to 70 percent	5	VALUE= 10	Water depth is >70% area 18" to 5'
d. Greater than 70 percent	10		
3) Percent Submergent Vegetation Cover			Drawdowns would allow SAV
a. Less than 10 percent	1		to grow to 30 to 50% cover 3 out of 10
b. 10 to 30 percent	3	ENTER	years on average, limited by PdT River
c. 30 to 50 percent	6	VALUE= 2	sediment loading, wind driven sediment
d. Greater than 50 percent	10		resuspension
4) Species of Submergent Vegetation Present (Key species: wild celery, sago pondweed, and other pondweeds)			
a. None of the key species present or less than 10 percent of aquatic bed	1		
b. At least one key species covers 10 to 30 percent of the aqutaic bed (add one point if more than one key species is present)	3	ENTER VALUE= 10	SAV is mostly sago pondweed
c. At least one key species covers 30 to 60 percent of the aquatic bed (add one point if more than one key species is present)	6		
d. Greater than 60 percent of aquatic bed is comprised of key food species	10		
5) Percent Emergent Vegetation Cover			
a. Less than 10 Percent or greater than 50 percent	1		
b. 10 to 20 percent or 30 to 50 percent	5	ENTER	
c. 20 to 30 percent	10	VALUE= 10	Drawdowns will increase EAV to >20%
6) Species of Emergent Vegetation Present (Key species: arrowhead (S. rigida), soft-stem bulrush, wild rice)			
a. None of the key species present or less than 10 percent fo aquatic bed	1		
b. At least one key species covers 10 to 30 percent of the aquatic bed (add one point if more than one key species is present)	3	ENTER VALUE= 4	Drawdowns will increase EAV diversity EAV will remain dominated by cattail
c. At least one key species covers 30 to 60 percent of the aqutaic bed (add one point if more than one key species is present)	6		
d. Greater than 60 percent of aquatic bed is comprised of key food species	10		
7) Invertebrate Populations Present (Key Species: Sphaeriidae, Gastropoda,Hexegenia spp,Chironomidae)			
a. None of the key taxonomic groups present or present but not abundant	1		
b. At least 1 key taxonomic group present and is moderately abundant	5	ENTER VALUE= 5	Macroinvertebrate community will remain dominated by chironomids, oligochaetes
c. At least 1 key taxonomic group present and is very abundant	10		
8) Disturbance			
a. Access uncontrolled - Considerable human activity during migration	1		
b. No hunting activity occurs, or closed to hunting only, but considerable human activity occurs during migration (such as fishing/boating)	3	ENTER VALUE= 4	Assume continued non-motorized zone
c. No hunting activity occurs, or closed to hunting only, and human activity during migration is minimal	4		
d. No human activity occurs, or closed to human entry	5		
		TOTAL= 55	
MAXIMUM POSSIBLE TOTAL =		75	
		HSI = 0.73	

<u>Alternative Measure 5</u> - Northern pike in Marsh Lake migrate into the flooded marsh area in upper Marsh Lake to spawn. Installing gated culverts in the Louisburg Grade Road would allow northern pike from Marsh Lake to successfully spawn during years when Marsh Lake is drawn down. Assuming that Marsh Lake would be drawn down once every five years to restore aquatic vegetation, the net gain in habitat units would be 610 AAHUs (Tables 22 and 23).

Table 22. Northern pike habitat in Marsh Lake with gated culverts in the Louisburg Grade Road, allowing successful northern pike reproduction in years when Marsh Lake is drawn down.

Northern pike habitat - Marsh Lake

Assume : There would be no change in the area of upper Marsh Lake = 1715 acres
There would be no change in the area of Marsh Lake = 6100 acres
Northern pike would have unobstructed access to upper Marsh Lake for spawning in all years except drawdown years
Increased SAV and EAV with Marsh Lake Dam modifications and drawdowns would improve habitat, but not the HS model value
No stoplog structures would be installed in the culverts under Louisburg Grade Road
Marsh Lake would be drawn down 10 times in 50 years

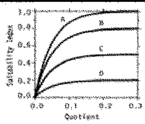
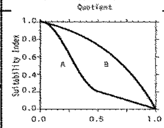
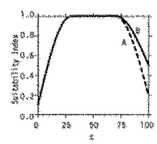
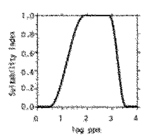
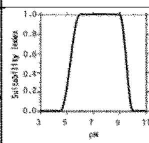
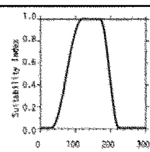
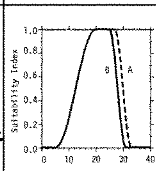
Northern Pike Habitat - Marsh Lake	Existing Conditions Year 0	Future With Project - Year 1	Future With Project - Year 5	Future With Project - Year 25	Future With Project - Year 50
HSI	0.8	0.8	0.8	0.8	0.8
Acreage	6100.0	6100.0	6100.0	6100.0	6100.0
Year	0.0	1.0	5.0	25.0	50.0
Cumulative Annual Habitat Units	0	4880.0	19520.0	97600.0	122000.0
				Total	244000.0
	No Action for Northern Pike			AAHU	4880
SI for years with drawdowns w/o gated culverts = 0.3, resulting in 1830 AHUs in drawdown years AAHU with drawdowns and without gated culverts = ((244000 - (4880 x 10) + (1830 x 10))/50					4270
			Alternative 5 Net Gain AAHU		610

Table 23. HEP model of northern pike habitat in Marsh Lake without gated culverts in the Louisburg Grade Road in years when Marsh Lake is drawn down.

Northern Pike Model (Lacustrine) Marsh Lake

With drawdowns future condition, without gated culverts in the Louisburg Grade Road

Assume : Northern pike occur in Marsh Lake, spawn in flooded vegetation in upper Marsh Lake
Northern pike would not successfully reproduce in Marsh Lake in drawdown years

	VARIABLE	VALUE	COMMENTS
V1	Ratio of spawning habitat area to midsummer habitat area Upper Marsh Lake = 1715 acres Marsh Lake = 6100 acres Ratio = 0.28, curve A = good vegetation	1.0	
V2	Drop in water level during embryo (A) and fry (b) stage, whichever is lowest Typically, Marsh Lake water levels during northern pike spawning are high and remain high for weeks During a drawdown, water levels during the fry stage would fall by approximately 0.75 m	0.3	
V3	Percent of midsummer area with SAV or EAV Marsh Lake EAV area = 1032 acres Marsh Lake SAV area = ~10% of 6100 acres = 610 26.9	1.0	
V4	Log10 summer TDS Mean Marsh Lake summer TDS = 675 mg/l Log10 of 675 = 2.829304	1.0	
V5	Least suitable pH during embyro and fry stages pH is ok - Corps data	1.0	
V6	Average length of frost-free season 135 days average at Milan MN R.H. Skaggs and D.G. Baker 1985 Fluctuations in the length of the growing season in Minnesota Climate Change http://www.springerlink.com/content/g65g3wl9k074w840/	1	
V7	Maximal weekly water temperature in summer A = unstratified lake 28C Corps data	0.8	

Habitat Suitability Index = lowest of the habitat suitability ratings 0.3

Alternative Measure 6 – Breaching the embankment enclosing the abandoned fish pond would provide aquatic habitat connectivity between the fish pond area and upper Lac qui Parle. Water levels in the fish pond area would fluctuate in concert with water levels in Lac qui Parle. Fish would gain access to the shallow aquatic habitat in the fish pond, improving foraging habitat for fish-eating birds like great blue herons. Great blue heron was selected as the representative species for habitat benefits analysis of this alternative measure. Breaching the abandoned fish pond would provide 5 additional AAHUs of blue heron habitat (Tables 24 and 25).

Table 24. Great blue heron habitat in the abandoned fish pond area with breached embankment.

Great Blue Heron Habitat

Assume : Heron nesting areas are available in wooded floodplain nearby
Habitat in abandoned fish pond area would improve (more forage fish) within one year after breaching dike
Area of abandonded fish pond = 15 acres

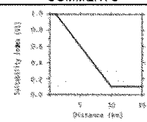
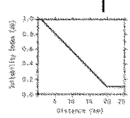
Wetland Habitat for Great blue heron in 500 ft wide band	Existing Conditions Year 0	Future With Project - Year 1	Future With Project - Year 5	Future With Project - Year 25	Future With Project - Year 50
HSI	0.31	0.69	0.69	0.69	0.69
Acreage	15.0	15.0	15.0	15.0	15.0
Year	0.0	1.0	5.0	25.0	50.0
Cumulative Annual Habitat Units	0.0	7.5	41.4	207.0	258.8
				Total	514.6
				AAHU	10
			Minus No Action for Herons		5
		Alternative 6 Net Gain AAHUs			5

Table 25. HEP model of great blue heron habitat in the reconnected abandoned fish pond area.

Great Blue Heron Model
With-Project Future Conditions

Assume : Heron foraging area in abandoned fish pond
Heron nesting areas are available in wooded floodplain nearby

V1 distance between foraging and nesting areas SI = 1.0
V2 foraging areas quality SI = 0.5
V3 disturbance in foraging areas SI = 1.0
V4 nesting trees SI = 1.0
V5 disturbance during nesting SI = 0.9
V6 distance between potential and active nest sites <2km SI = 1.0
HSI = (V1 x V2 x V3 x V4 x V5 x V6) exp 0.5 = 0.69

	VARIABLE	VALUE	COMMENTS
V1	Distance between foraging areas and existing or potential heronries < 5 km	0.6	
V2	Foraging area quality Heron foraging area in abandoned fish pond improved by connection to upper Lac qui Parle, forage fish gain access	1	V2 = 1.0 if potential foraging habitats usually have shallow, clear water with a firm substrate and a huntable population of small fish. V2 = 0.0 if potential foraging habitats usually do not provide the desirable combination of conditions.
V3	Disturbance in foraging areas Little human disturbance in these areas	1	V3 = 1.0 if there usually is no human disturbance near the potential foraging zone during the 4 hours following sunrise or preceding sunset or the foraging zone is generally about 100 m from human activities and habitation or about 50 m from roads with occasional, slow-moving traffic. V3 = 0.0 if the above conditions are not usually met.
V4	Potential nesting areas Assume potential nesting areas are available and suitable	1	Variable 4 (V4) in the model defines a potential nest site as a grove of trees at least 0.4 ha in area located over water or within 250 m of water. These potential nest sites may be on an island within a river or lake, within a woodland dominated swamp, or in vegetation near a river or lake. Trees used as nest sites are at least 5 m high and have many branches at least 2.5 cm in diameter that are capable of supporting nests. Trees may be alive or dead but must have an "open canopy" that allows an easy access to the nest. V4 = 1.0 if potential treeland habitats usually fulfill all of these conditions. V4 = 0.0 if potential treeland habitats usually do not fulfill all of these conditions.
V5	Disturbance in nesting areas Assume nesting areas receive little human disturbance	1	V5 = 1.0 if the exclusion zone is usually free from human disturbances during the nesting season. V5 = 0.0 if the exclusion zone is usually not free from human disturbance during the nesting season.
V6	Distance between potential and active nest sites Assume distance is < 5 km	0.8	 Figure 3. Distance between a potential nest site and an active nest site modifies SI values.

HSI = (V1 x V2 x V3 x V4 x V5 x V6) exp 0.5
HSI = (0.6 x 1.0 x 1 x 1 x 1 x 0.8) exp 0.5   0.69

<u>Alternative Measure 7</u> – Constructing islands in Marsh Lake would reduce wind fetch, sediment resuspension, and increase submersed aquatic vegetation that provides food for migrating diving ducks.

This stand-alone measure would increase submersed aquatic vegetation but significant inter-annual variation in the extent of submersed aquatic vegetation would occur. Sediment loading from the Pomme de Terre River and sediment resuspension and grazing by carp would combine to limit submersed aquatic vegetation under this stand-alone alternative to an estimated three years out of ten of abundant SAV. This stand-alone alternative measure would provide a net gain of 239 AAHUs of diving duck migration habitat (Tables 26 and 27).

Table 26. Diving duck habitat in Marsh Lake with islands.

Diving duck migration habitat

Assume : There would be no change over time in the area of Marsh Lake = 6100 acres average growing season area
Islands would protect against sediment resuspension and increase extent of SAV in the first year following construction

Lake Migration Habitat for Diving Ducks	Existing Conditions Year 0	Future With Project - Year 1	Future With Project - Year 5	Future With Project - Year 25	Future With Project - Year 50
HSI	0.56	0.65	0.65	0.65	0.65
Acreage	6100.0	6100.0	6100.0	6100.0	6100.0
Year	0.0	1.0	5.0	25.0	50.0
Cumulative Annual Habitat Units	0	3690.5	15860.0	79300.0	99125.0
				Total	197975.5
				AAHU	3960

Alternative 7 Total AAHU	3960
No Action Total AAHU	3721
Alternative 7 Net Gain AAHU	239

Table 27. HEP model of diving duck habitat in Marsh Lake with islands.

DIVING DUCK MIGRATION HABITAT MODEL
MARSH LAKE MINNESOTA RIVER - **WITH ISLANDS FUTURE PROJECT CONDITION**

VARIABLE		VALUE	COMMENTS
1) Size of Water Body			
a. Less than 100 acres	1		
b. 100 to 200 acres	5	ENTER	
c. 200 to 1,000 acres	7	VALUE= 10	Marsh Lake is >1000 acres
d. Greater than 1,000 acres	10		
2) Water Depth - Percent of Area 18" to 5'			
a. Less than 10 percent	1		
b. 10 to 40 percent	3	ENTER	
c. 40 to 70 percent	5	VALUE= 10	Water depth is >70% area 18" to 5'
d. Greater than 70 percent	10		
3) Percent Submergent Vegetation Cover			
a. Less than 10 percent	1		Islands would allow SAV to grow to 30 to 50% cover 3 out of 10 years on average, limited by PdT River sediment loading, sediment resuspension by carp and carp grazing
b. 10 to 30 percent	3	ENTER	
c. 30 to 50 percent	6	VALUE= 2	
d. Greater than 50 percent	10		
4) Species of Submergent Vegetation Present (Key species: wild celery, sago pondweed, and other pondweeds)			
a. None of the key species present or less than 10 percent of aquatic bed	1		
b. At least one key species covers 10 to 30 percent of the aqutaic bed (add one point if more than one key species is present)	3	ENTER VALUE= 10	SAV is mostly sago pondweed
c. At least one key species covers 30 to 60 percent of the aquatic bed (add one point if more than one key species is present)	6		
d. Greater than 60 percent of aquatic bed is comprised of key food species	10		
5) Percent Emergent Vegetation Cover			
a. Less than 10 Percent or greater than 50 percent	1		
b. 10 to 20 percent or 30 to 50 percent	5	ENTER	Islands will shelter EAV,
c. 20 to 30 percent	10	VALUE= 5	increase to >10%
6) Species of Emergent Vegetation Present (Key species: arrowhead (S. rigida), soft-stem bulrush, wild rice)			
a. None of the key species present or less than 10 percent fo aquatic bed	1		
b. At least one key species covers 10 to 30 percent of the aqutaic bed (add one point if more than one key species is present)	3	ENTER VALUE= 3	Assume EAV will increase in diversity
c. At least one key species covers 30 to 60 percent of the aqutaic bed (add one point if more than one key species is present)	6		
d. Greater than 60 percent of aquatic bed is comprised of key food species	10		
7) Invertebrate Populations Present (Key Species: Sphaeriidae, Gastropoda,Hexegenia spp,Chironomidae)			
a. None of the key taxonomic groups present or present but not abundant	1		
b. At least 1 key taxonomic group present and is moderately abundant	5	ENTER VALUE= 5	Invertebrate community will remain dominated by chironomids, oligochaetes
c. At least 1 key taxonomic group present and is very abundant	10		
8) Disturbance			
a. Access uncontrolled - Considerable human activity during migration	1		
b. No hunting activity occurs, or closed to hunting only, but considerable human activity occurs during migration (such as fishing/boating)	3	ENTER VALUE= 4	Assume continued non-motorized zone
c. No hunting activity occurs, or closed to hunting only, and human activity during migration is minimal	4		
d. No human activity occurs, or closed to human entry	5		
		TOTAL= 49	
MAXIMUM POSSIBLE TOTAL =		75	
		HSI = 0.65	

Combinations of Alternative Measures

__Alternative Measures 2, 3, 4, and 7__

These measures implemented together would have synergistic effects. Given the difficulty in restoring shallow lakes it would be best to implement these measures together. These measures would in combination, contribute to restoring a vegetated clearer water ecosystem state in Marsh Lake, improving habitat conditions for migrating diving ducks, other waterfowl and shorebirds. Measure 4 implemented along with the others would provide water level management flexibility to adaptively respond to conditions in Marsh Lake, reducing the inter-annual variation in the abundance of aquatic vegetation and habitat conditions for waterfowl.

Restoring the Pomme de Terre River to its former channel would reduce sediment loading to Marsh Lake and reduce carp abundance, This would improve water clarity allowing increased growth of submersed aquatic vegetation and would reduce the abundance of carp that resuspend sediment and graze on aquatic vegetation by denying them winter dissolved oxygen refuge in the Pomme de Terre River.

Modifying Marsh Lake Dam with a fishway to attain target water levels would reduce the duration of high water events on Marsh Lake and provide more consistent water depth, allowing increased growth of submersed aquatic plants.

Conducting growing season drawdowns on Marsh Lake using a stop log water control structure would restore both emergent and submersed aquatic plants. Increased extent of emergent aquatic plants would reduce wind fetch and sediment resuspension. Winter drawdowns of Marsh Lake would reduce carp abundance, sediment resuspension and grazing by carp on submersed aquatic plants.

Constructing islands in Marsh Lake would increase submersed aquatic plants by significantly reducing wind fetch and sediment resuspension.

Considering the future ecosystem conditions in Marsh Lake with the combination of Alternative Measures 2, 3, 4, and 7, diving duck migration habitat conditions would be better than with the stand-alone alternative measures. Implementing these alternative measures together would result in 1326 AAHUs for diving duck migration habitat (Tables 28, 29).

Table 28. Diving duck migration habitat on Marsh Lake with combination of Alternative measures 2, 3, 4, and 7.

Diving duck migration habitat

Assume : There would be no change over time in the area of Marsh Lake = 6100 acres average growing season area
Alt 2 Re-routing PdT River to former channel will reduce sediment loading to Marsh Lake, increase water clarity, SAV growth reduce over-winter survival of carp
Alt 3 Modify Marsh Lake Dam to attain target water levels, construct fishway will increase SAV growth
Alt 4 Drawdowns of Marsh Lake with stop log water control structure will increase EAV and SAV growth
Winter drawdowns of Marsh Lake will reduce carp abundance
Alt 7 Islands would protect against sediment resuspension and increase extent of SAV
If implemented together, these alternative measures would improve habitat condtiions in the first year following construction

Lake Migration Habitat for Diving Ducks	Existing Conditions Year 0	Future With Project - Year 1	Future With Project - Year 5	Future With Project - Year 25	Future With Project - Year 50
HSI	0.56	0.83	0.83	0.83	0.83
Acreage	6100.0	6100.0	6100.0	6100.0	6100.0
Year	0.0	1.0	5.0	25.0	50.0
Cumulative Annual Habitat Units	0	4239.5	20252.0	101260.0	126575.0
				Total	252326.5
				AAHU	5047

Combination Alternatives 2,3,4,7 Total AAHU	5047
No Action Total AAHU	3721
Alternative 7 Net Gain AAHU	1326

Table 29. HEP model of diving duck habitat in Marsh Lake with combination of alternative measures 2, 3, 4, and 7.

DIVING DUCK MIGRATION HABITAT MODEL
Marsh Lake with Pomme de Terre River restored to its former channel, attaining target water levels with a fishway, growing season and winter drawdowns using stoplog control structure, and with constructed islands

VARIABLE		VALUE	COMMENTS
1) Size of Water Body			
a. Less than 100 acres	1		
b. 100 to 200 acres	5	ENTER	
c. 200 to 1,000 acres	7	VALUE= 10	Marsh Lake is >1000 acres
d. Greater than 1,000 acres	10		
2) Water Depth - Percent of Area 18" to 5'			
a. Less than 10 percent	1		
b. 10 to 40 percent	3	ENTER	
c. 40 to 70 percent	5	VALUE= 10	Water depth is >70% area 18" to 5'
d. Greater than 70 percent	10		
3) Percent Submergent Vegetation Cover			
a. Less than 10 percent	1		Islands and drawdowns would allow SAV to grow to >50% cover most years
b. 10 to 30 percent	3	ENTER	
c. 30 to 50 percent	6	VALUE= 10	
d. Greater than 50 percent	10		
4) Species of Submergent Vegetation Present (Key species: wild celery, sago pondweed, and other pondweeds)			
a. None of the key species present or less than 10 percent of aquatic bed	1		
b. At least one key species covers 10 to 30 percent of the aqutaic bed (add one point if more than one key species is present)	3	ENTER VALUE= 10	SAV is mostly sago pondweed
c. At least one key species covers 30 to 60 percent of the aquatic bed (add one point if more than one key species is present)	6		
d. Greater than 60 percent of aquatic bed is comprised of key food species	10		
5) Percent Emergent Vegetation Cover			
a. Less than 10 Percent or greater than 50 percent	1		
b. 10 to 20 percent or 30 to 50 percent	5	ENTER	Drawdowns will allow germination of EAV,
c. 20 to 30 percent	10	VALUE= 10	islands will shelter EAV, increase cover to >20%
6) Species of Emergent Vegetation Present (Key species: arrowhead (S. rigida), soft-stem bulrush, wild rice)			
a. None of the key species present or less than 10 percent fo aquatic bed	1		
b. At least one key species covers 10 to 30 percent of the aqutaic bed (add one point if more than one key species is present)	3	ENTER VALUE= 3	EAV will increase in diversity
c. At least one key species covers 30 to 60 percent of the aqutaic bed (add one point if more than one key species is present)	6		
d. Greater than 60 percent of aquatic bed is comprised of key food species	10		
7) Invertebrate Populations Present (Key Species: Sphaeriidae, Gastropoda,Hexegenia spp,Chironomidae)			
a. None of the key taxonomic groups present or present but not abundant	1		
b. At least 1 key taxonomic group present and is moderately abundant	5	ENTER VALUE= 5	Invertebrate community will remain dominated by chironomids, oligochaetes
c. At least 1 key taxonomic group present and is very abundant	10		
8) Disturbance			
a. Access uncontrolled - Considerable human activity during migration	1		
b. No hunting activity occurs, or closed to hunting only, but considerable human activity occurs during migration (such as fishing/boating)	3	ENTER VALUE= 4	Assume continued non-motorized zone
c. No hunting activity occurs, or closed to hunting only, and human activity during migration is minimal	4		
d. No human activity occurs, or closed to human entry	5		
		TOTAL= 62	

MAXIMUM POSSIBLE TOTAL = 75

HSI = 0.83

Net Habitat Benefits of the Alternative Measures

Table 32 provides the net habitat benefits of the alternative measures and combinations of alternative meausures expressed as AAHUs, based on the selected representative species, models, acres affected and timing of habitat improvements.

Table 32. Net habitat benefit of the alternative measures for the Marsh Lake project.

Measure Number	Alternative Measures	Net Benefit (AAHU)
1	No Action	0
2	Restore Pomme de Terre River to its former channel	6567
3	Modify Marsh Lake Dam to attain target water levels, construct fishway	483
4	Growing season drawdowns to restore emergent aquatic plants, modify Marsh Lake Dam with stoplog structure	725
5	Install gated culverts in Louisburg Grade Road	610
6	Breach dike at abandoned fish pond	5
7	Construct islands in Marsh Lake	239
	Combinations of Measures	
2,3,4,7	PdT River to former channel	1326
	Modify Marsh Lake Dam with fishway	
	Modify Marsh Lake Dam with stop log structure, drawdowns	
	Construct islands in Marsh Lake	
3,4,5	Modify Marsh Lake Dam to attain target water levels, construct fishway	1372
	Growing season drawdowns to restore emergent aquatic plants, modify Marsh Lake Dam with stoplog structure	
	Install gated culverts in Louisburg Grade Road	

Appendix F – Hazardous, Toxic, and Radioactive Waste Assessment

PHASE I
ENVIRONMENTAL SITE
ASSESSMENT REPORT

Project Site:

Marsh Lake Ecosystems Restoration
Minnesota River Valley, Big Stone and Swift Counties, Minnesota

Prepared by:

United States Army Corps of Engineers – St. Paul District
Geotechnical, Geology, and Surveys Section
190 5th Street E.
St. Paul, Minnesota 55101

31 March 2011

TABLE OF CONTENTS

List of Acronyms

- ACM - Asbestos Containing Material
- AST - Aboveground Storage Tank
- ASTM – American Society for Testing Materials
- CAT - Illinois State Category List
- CERCLIS - Comprehensive Environmental Response, Compensation, and Liability Information System
- CONSENT - Superfund Consent Decrees
- CORRACTS - Corrective Action Sites
- EDI - Environmental Design International
- EDR - Environmental Data Resources
- ERNS - Emergency Response Notification System
- ESA - Environmental Site Assessment
- FINDS - Facility Index System
- FOIA - Freedom of Information Act
- FTTS INSP - Federal Insecticide, Fungicide, & Rodenticide Act/ TSCA Tracking System
- HMIRS - Hazardous Materials Information Reporting System
- LQG - Large Quantity Generators
- LUST - Minnesota Leaking Underground Storage Tank List
- MPCA – Minnesota Pollution Control Agency
- NPL - National Priorities List
- NPL LIENS - Federal Superfund Liens
- NWI - National Wetlands Inventory
- PADS - PCB Activity Database System
- PCBs - Polychlorinated Biphenyls
- PDF – Portable Digital Format
- RAATS - RCRA Administrative Action Tracking System
- RCRIS - Resource Conservation and Recovery Information System
- REC – Recognized Environmental Condition
- ROD - Records of Decision
- SHWS - Minnesota State Hazardous Waste Sites
- SQG - Small Quantity Generators
- SSTS - Section 7 Tracking Systems
- TRIS - Toxic Chemical Release Inventory System
- TSCA - Toxic Substances Control Act Inventory
- TSD - Treatment, Storage, and Disposal
- USGS – United States Geological Survey
- UST - Underground Storage Tank
- VIC – Minnesota Voluntary Investigation and Cleanup Program

EXECUTIVE SUMMARY

A Phase I Environmental Site Assessment (ESA) was conducted for property located in proposed mitigation areas located at Marsh Lake and the Marsh Lake Dam, Minnesota at Marsh Lake and the Pomme de Terre River in rural Swift and Big Stone Counties. Property reconnaissance was conducted at the site on 27 March, 2011. The inspection and review of available records revealed the following:

Site History

The subject properties are located at Marsh Lake, and on the Pomme de Terre River, southwest of the town of Appleton, Minnesota. The proposed mitigation areas encompass the Pomme de Terre river along the northern section of Marsh Lake Dam, and Louisberg Road at the north end of Marsh Lake.

The subject property and its environs up to a radius of 1 mile underwent a search of federal, state, local and tribal environmental databases in an effort to identify any potential environmental conditions of concern. No recognized environmental conditions were identified through the database search.

Historical land use and any potential environmental conditions may be identified through the study of fire insurance maps, aerial photographs, and U.S.G.S. topographic maps. A map and photo search was undertaken and no recognized environmental conditions were identified through this search.

The subject properties were visually inspected. No recognized environmental conditions were identified during the inspections and nothing was observed to constitute a significant environmental risk at the site.

The Executive Summary provides a brief overview of the findings of this environmental site assessment. It should be noted that the complete report must be read in order to fully understand the findings associated with the subject properties.

PURPOSE

The purpose of this assessment was to identify recognized environmental conditions and potential environmental conditions based on a visual inspection of the subject property and the surrounding operations, and a review of available public records relative the subject property. A recognized environmental condition is defined by ASTM Standard Practice E-1527 and E-2247 as the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property. This assessment does not intend to include *de minimis* conditions that generally do not present a material risk of harm to public health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies.

The Phase I ESA is in conformance with the scope of ASTM Standard Practice E-1527. The scope of work is further defined below.

A. COE has gathered and reviewed available historical data, including fire insurance mapping, plats of survey maps, soil survey aerial photography, topographic maps from the United States Geological Survey (USGS), and interviews with knowledgeable persons.

B. COE has reviewed state and federal environmental databases including UST, LUST, RCRA, CERCLA, NPL, Landfill, ERNS, CORRACTS, PADS, TRI, DOCKET, TSCA, SCL, SRP, and SWF.

C. COE has physically inspected the subject property via walking and windshield survey, looking for signs of recognized environmental conditions such as stressed vegetation, unusual staining, dumping, and evidence of ASTs and USTs.

D. COE has physically observed adjacent properties, paying particular attention to evidence of USTs, questionable housekeeping practices or unusual business practices.

E. COE has reviewed all available historical data, database information, received FOIA information, and the results of the site inspections.

The conclusions and recommendations stated in this report are based upon observations made by individuals working for the Corps of Engineers, and also upon information provided by others. We have accepted as true and accurate the information provided by other sources; therefore we cannot be held responsible for the accuracy of this information.

The Phase I Assessment was conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the environmental profession under similar conditions. No other warranty or guarantee, express or implied, is included or intended in this report or otherwise.

The Scope of this Assessment does not purport to encompass every report, record, or other form of documentation relevant to the Property being evaluated. The observations contained herein are made during the site reconnaissance, review of ownership records, discussions with local officials, and review of readily accessible environmental databases. This Phase I Assessment is based on our professional judgment concerning the significance of the data collected and in no way attempts to forecast the future site conditions.

SITE DESCRIPTION

Property Location

The subject properties are located on the Minnesota River, southwest of the town of Appleton, Minnesota. The proposed mitigation areas encompass the Pomme de Terre River from approximately one mile upstream of the Marsh Lake Dam, to its confluence with Marsh Lake, and the Lake crossing at Louisburg Road at the upstream end of Marsh Lake, southwest of the town of Correll, Minnesota. The Louisburg road mitigation area is located in the USGS 7.5-minute quadrangle map Correll, Minnesota, township 120 north, range 44 west, sections 8 and 17 and the Pomme de Terre River mitigation are is located in the 7.5-minute quadrangle map Appleton, Minnesota, township 120 north, range 43 west, sections 29 and 30. The proposed borrow area for the mitigation efforts is located in the 7.5-minute quadrangle map Appleton, Minnesota, township 120 north, range 43 west, section 19. The site location map is provided as Figure 1.

General Site Setting

The COE owns most of the land in the area of the mitigation project. Land use in the area of the subject property is natural lake shore, marshes, and river flood plains. The proposed borrow area is an agricultural field currently unplanted for the winter season. The subject properties themselves are covered with native grasses and bottom land forest. The surficial soils are clayey. The closest town in proximity is Appleton, Minnesota with a population of approximately 2,683 (2007 census estimate), and a total population of 11,370 in all of Swift County. The nearest town in Big Stone county is Correll, Minnesota, with a population of 43 (2009).

Current Use of Adjoining Properties

The adjoining properties are limited in number and are agricultural in nature. The area is rural and has a relatively low surrounding population. No manufacturing or commercial business is located in the immediate vicinity.

Owner Provided Information

The COE owns most of the land in the area of the mitigation project. The COE has not yet conducted telephone interviews with local landowners. The purpose of the interviews will be to determine if there are any known past or present environmental concerns associated with the sites. No environmental concerns are expected to be identified from future interviews.

Any information from, and analysis of future interviews will be included in subsequent submittals.

HISTORICAL USE OF THE PROPERTY

Sanborn Fire Insurance Maps

Historical Fire Insurance Sanborn Maps were requested from Environmental Data Resources, Inc. (EDR), Southport, Connecticut. Historical maps are detailed drawings that show the locations and use of structures on a given property during a specific year. The maps were originally used by insurance companies to assess fire risk. EDR had no coverage for the Sanborn maps. This is consistent with the areas rural character.

Copies of the Sanborn reports are provided in Appendix F2.

Topographic Maps

Historical topographic map coverage of Marsh Lake was requested from EDR. USGS 7.5 Appleton quadrangle maps at the Marsh Lake Dam were obtained for the years 1958 and 1977. USGS 7.5 Correll quadrangle maps at the Louisburg road were obtained for the year 1958. The 1950 and 1974 topographic maps depict the subject property and adjacent properties as similar to what was observed at the time of the property reconnaissance.

Partial copies of the topographic maps are provided in Appendix F3.

No environmental conditions were identified from the topographic maps.

Aerial Photos

Historical photos of Marsh Lake mid-pool were requested from EDR. Photo coverage was available for the years 1938, 1955, 1968, 1991, 1996, 2005, and 2006. All photos reveal that the islands mid pool are uninhabited and natural, with only minor geomorphologic changes throughout the years. The photo from 1955 is the only one that covers some land to the south of the lake, and that land is agricultural in use, and rural in character.

Copies of the aerial photos are provided in Appendix F4.

No environmental conditions were identified from the aerial photographs.

Historical photos of Marsh Lake Dam and Louisburg road have been requested from the EDR and analysis of any documentation received will be included in subsequent submittals.

REGULATORY REVIEW

A Government Records Search Radius Map Report was requested for the subject property from Environmental Data Resources, Inc. (EDR). The EDR Radius Map Report maps sites with potential or existing environmental liabilities. The following is a list of the databases searched for the subject property accompanied by a summary of sites listings. Copies of the EDR Radius Map Reports are provided in Appendix F5.

Federal Records:

- **NPL** - National Priorities List
- **NPL Proposed**
- **NPL LIENS** - Federal Superfund Liens
- **NPL Delisted**
- **CERCLIS (Active)** - Comprehensive Environmental Response, Compensation, and Liability Information System
- **CERCLIS (NFRAP)** - No Further Remedial Action Planned Archive
- **CORRACTS** - Resource Conservation and Recovery Information System (RCRIS) list of Treatment, Storage, and Disposal (TSD) Facilities, Corrective Action Sites
- **RCRA – TSDF** Resource Conservation and Recovery Act Information
- **RCRA – LQG** Resource Conservation and Recovery Act Information
- **RCRA – SQG** Resource Conservation and Recovery Act Information
- **ERNS** - Emergency Response Notification System
- **HMIRS** - Hazardous Materials Information Reporting System
- **US ENGINEERING CONTROLS**
- **US INSTITUTIONAL CONTROLS**
- **DOD** – Department of Defense
- **FUDS** – Formerly Used Defense Sites
- **US BROWNFIELDS**
- **CONSENT** - Superfund Consent Decrees
- **ROD** - Records of Decision
- **UMTRA** – Uranium Mill Tailings Sites
- **ODI** – Open Dump Inventory
- **TRIS** – Toxic Chemical Release Inventory System

- **TSCA** – Toxic Substances Control Act
- **FTTS** - Federal Insecticide, Fungicide, & Rodenticide Act/ TSCA Tracking System
- **SSTS** – Section 7 Tracking Systems
- **RADINFO** – Radiation Information Database
- **LUCIS** – Land Use Control Information System
- **ICIS** – Integrated Compliance Information System
- **DOT OPS** – Incident and Accident Data
- **LIENS 2** – CERCLA Lien Information
- **US CDL** – Clandestine Drug Labs
- **HIST FTTS** – FIFRA/TSCA Tracking System Administrative Case Listing
- **PADS** – PCB Activity Database System
- **MLTS** – Material Licensing Tracking System
- **MINES** – Mines Master Index File
- **FINDS** – Facility Index System/Facility Registry System
- **RAATS** – RCRA Administrative Action Tracking System

State and Local Records:

- **SHWS** – Hazard Ranking List
- **BRRTS** – Bureau of Remediation & Redevelopment Tracking System
- **WI ERP** – Environmental Repair Program database
- **SWF/LF** – List of Licensed Landfills
- **WI WDS** – Registry of Waste Disposal Sites
- **LUST** – Leaking Underground Storage Tank Database
- **UST** – Registered Underground Storage Tanks
- **LAST** – Leaking Aboveground Storage Tank Listing
- **AST** – Tanks Database
- **WI MANIFEST** – Hazardous Waste Manifest Data
- **WI Spills** – Spills Database
- **AGSPILLS** – Agricultural Spill cases
- **CRS** – Closed Remediation Sites
- **AUL** – Deed Restriction at Closeout Sites
- **VCP** – Voluntary Party Liability Exemption Sites
- **DRYCLEANERS** – Five Star Recognition Program Sites
- **WI WRRSER** – Wisconsin Remedial Response Site Evaluation Report
- **BEAP** – Brownfields Environmental Assessment Program
- **AIRS** – Air Permit Program Listing
- **TIER 2** – Tier 2 Facility Listing
- **SHWIMS** – Solid & Hazardous Waste Information Management System
- **LEAD** – Lead Inspection Data

Tribal Records:

- **INDIAN RESERV** – Indian Reservations

- **INDIAN LUST** – Leaking Underground Storage Tanks on Indian Land
- **INDIAN UST** – Underground Storage Tanks on Indian Land

EDR Proprietary Records:

- **Manufactured Gas Plants** – EDR Proprietary Manufactured Gas Plants

The search was conducted for a radius of 2-miles from the mid-pool of Marsh Lake, 1.5 miles from Louisberg road, and 1.5 miles again from the Marsh Lake Dam. The target properties were not listed in any of the databases checked. No mapped sites were found in the search of available Government records within the search radius around the target properties.

PROPERTY RECONNAISSANCE

27 March, 2011

Ellen Engberg from the US Army Corps of Engineers, St. Paul District conducted the property reconnaissance. The weather at the time of the site visit was cold (approximately 30 degrees) and sunny.

The subject property is located along the northeast section of the Marsh Lake Dam. The Pomme de Terre River runs along the northwest side of the dam, and was flooded at the time of the site visit. The historical channel runs along the southeast side of the dam, and was also flooded at the time of the reconnaissance.

The land is covered in flood plain forest dominated by willow, silver maple, cottonwood, green ash, and box elder. Ground vegetation was not visible due to flooding.

Access to the borrow area was not possible due to snow cover, but was visually observed from a distance.

No structures were observed during the inspection.

The database search revealed no wells on the subject property. The entire site was free from litter or man-made debris.

No potential on-site recognized environmental conditions were observed during the property reconnaissance.

CONCLUSIONS and RECOMMENDATIONS

The Corps of Engineers have performed a Phase I Environmental Site Assessment in conformance with the scope and limitations of ASTM Practice E 1527 of the Marsh Lake Mitigation area.

This assessment revealed no evidence of recognized environmental conditions in connection with any of the subject properties.

Agricultural activities have historically been conducted at adjacent sites. Agricultural chemicals, including herbicides and pesticides, are expected to have been applied to the crops and ground surface at various times throughout its history. The disseminated nature of these chemicals, when used properly, should not constitute a significant environmental risk at the site.

A Phase II environmental Site Assessment is not recommended for the subject properties.

QUALIFICATIONS of the PROFESSIONAL RESPONSIBLE FOR THIS REPORT

The professional responsible for the preparation of this Phase I Environmental Site Assessment is identified below.

____

Grant A. Riddick P.G.
Geologist
Mr. Riddick has over 20 years experience in drilling, sampling, environmental and geotechnical engineering support.

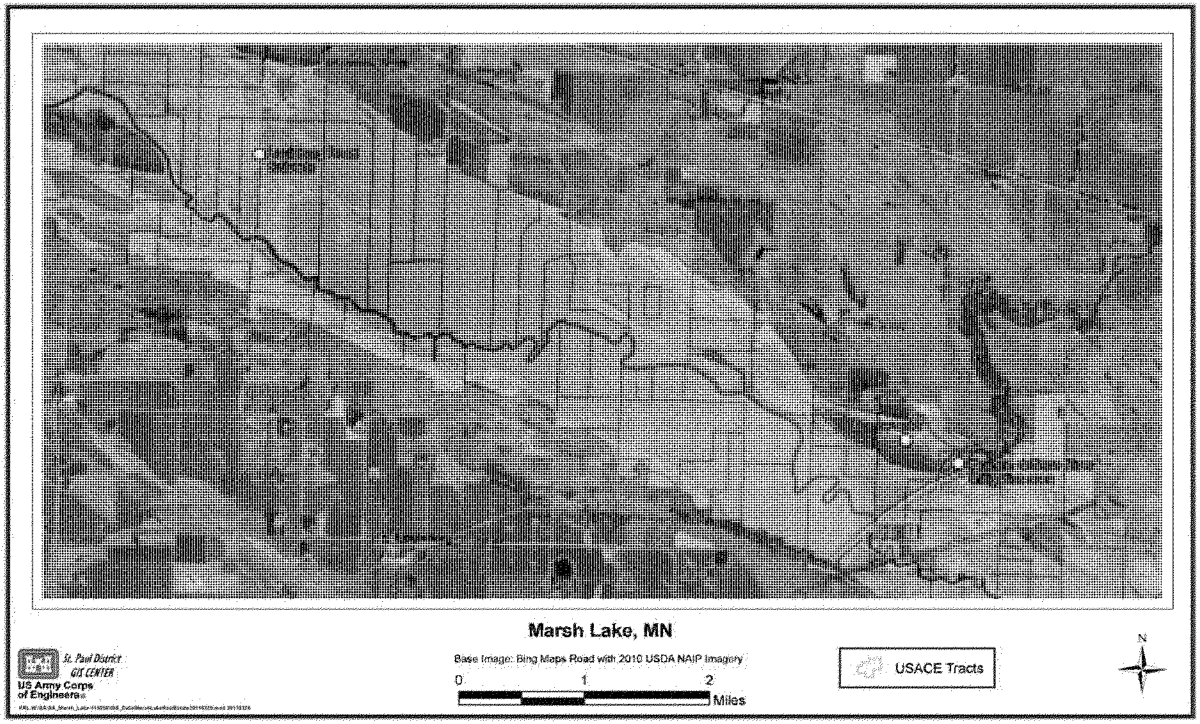


Figure 1. General Site Map / Marsh Lake / Proposed Mitigation Properties

Appendix F1

Site Photographs

SITE PHOTOGRAPHS

Photo #1

From Marsh Lake Dam looking west at approximate location of cut off dike

Photo #2

From Marsh Lake Dam looking southeast at approximate location of the new Pomme de Terre river crossing

Photo #3

From Marsh Lake Dam looking northwest at approximate location of the new Pomme de Terre river crossing

Photo #4

From Marsh Lake Dam looking east at the historic Pomme de Terre river channel

Appendix F2

EDR Sanborn Fire Insurance Map Reports

Marsh Lake
Louisburg Road
Appleton, MN 56208

Inquiry Number: 3028253.3
March 31, 2011

Certified Sanborn® Map Report

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
800.352.0050
www.edrnet.com

Certified Sanborn® Map Report

3/31/11

Site Name:	Client Name:
Marsh Lake	Army Corp of Engineers
Louisburg Road	190 5th Street E
Appleton, MN 56208	SAint Paul, MN 55101
EDR Inquiry # 3028253.3	Contact: Ellen Engberg

EDR® Environmental Data Resources Inc

The complete Sanborn Library collection has been searched by EDR, and fire insurance maps covering the target property location provided by Army Corp of Engineers were identified for the years listed below. The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by Sanborn Library LLC, the copyright holder for the collection.

Certified Sanborn Results:

Site Name:	Marsh Lake
Address:	Louisburg Road
City, State, Zip:	Appleton, MN 56208
Cross Street:	
P.O. #	NA
Project:	Marsh Lake
Certification #	E96B-4B8E-84DA

Sanborn® Library search results
Certification # E96B-4B8E-84DA

UNMAPPED PROPERTY

This report certifies that the complete holdings of the Sanborn Library, LLC collection have been searched based on client supplied target property information, and fire insurance maps covering the target property were not found.

The Sanborn Library includes more than 1.2 million Sanborn fire insurance maps, which track historical property usage in approximately 12,000 American cities and towns. Collections searched:

- ✓ Library of Congress
- ✓ University Publications of America
- ✓ EDR Private Collection

The Sanborn Library LLC Since 1866™

Limited Permission To Make Copies

Army Corp of Engineers (the client) is permitted to make up to THREE photocopies of this Sanborn Map transmittal and each fire insurance map accompanying this report solely for the limited use of its customer. No one other than the client is authorized to make copies. Upon request made directly to an EDR Account Executive, the client may be permitted to make a limited number of additional photocopies. This permission is conditioned upon compliance by the client, its customer and their agents with EDR's copyright policy; a copy of which is available upon request.

Marsh Lake Dam
Marsh Lake
Madison, MN 56256

Inquiry Number: 2627945.3
October 30, 2009

Certified Sanborn® Map Report

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
800.352.0050
www.edrnet.com

Certified Sanborn® Map Report

10/30/09

Site Name:	Client Name:
Marsh Lake Dam	Army Corp of Engineers
Marsh Lake	190 5th Street E
Madison, MN 56256	SAint Paul, MN 55101
EDR Inquiry # 2627945.3	Contact: Grant Riddick

EDR® Environmental Data Resources Inc

The complete Sanborn Library collection has been searched by EDR, and fire insurance maps covering the target property location provided by Army Corp of Engineers were identified for the years listed below. The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by Sanborn Library LLC, the copyright holder for the collection.

Certified Sanborn Results:

Site Name: Marsh Lake Dam
Address: Marsh Lake
City, State, Zip: Madison, MN 56256
Cross Street:
P.O. # #1
Project: Marsh Lake Dam
Certification # CD00-40D3-A823

Sanborn® Library search results
Certification # CD00-40D3-A823

UNMAPPED PROPERTY

This report certifies that the complete holdings of the Sanborn Library, LLC collection have been searched based on client supplied target property information, and fire insurance maps covering the target property were not found.

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Louisburg Road
Louisburg Road
Correll, MN 56227

Inquiry Number: 3028253.11
March 31, 2011

Certified Sanborn® Map Report

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
800.352.0050
www.edrnet.com

Certified Sanborn® Map Report

3/31/11

Site Name:	Client Name:
Louisburg Road	Army Corp of Engineers
Louisburg Road	190 5th Street E
Correll, MN 56227	SAint Paul, MN 55101
EDR Inquiry # 3028253.11	Contact: Ellen Engberg

EDR® Environmental Data Resources Inc

The complete Sanborn Library collection has been searched by EDR, and fire insurance maps covering the target property location provided by Army Corp of Engineers were identified for the years listed below. The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by Sanborn Library LLC, the copyright holder for the collection.

Certified Sanborn Results:

Site Name: Louisburg Road
Address: Louisburg Road
City, State, Zip: Correll, MN 56227
Cross Street:
P.O. # NA
Project: marsh lake
Certification # C051-4C81-8F6B

Sanborn® Library search results
Certification # C051-4C81-8F6B

UNMAPPED PROPERTY

This report certifies that the complete holdings of the Sanborn Library, LLC collection have been searched based on client supplied target property information, and fire insurance maps covering the target property were not found.

The Sanborn Library includes more than 1.2 million Sanborn fire insurance maps, which track historical property usage in approximately 12,000 American cities and towns. Collections searched:

- ✓ Library of Congress
- ✓ University Publications of America
- ✓ EDR Private Collection

The Sanborn Library LLC Since 1866™

Limited Permission To Make Copies

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Appendix F3

EDR Topographic Map Reports

Marsh Lake
Louisburg Road
Appleton, MN 56208

Inquiry Number: 3028253.4
March 31, 2011

EDR Historical Topographic Map Report

EDR® Environmental Data Resources Inc

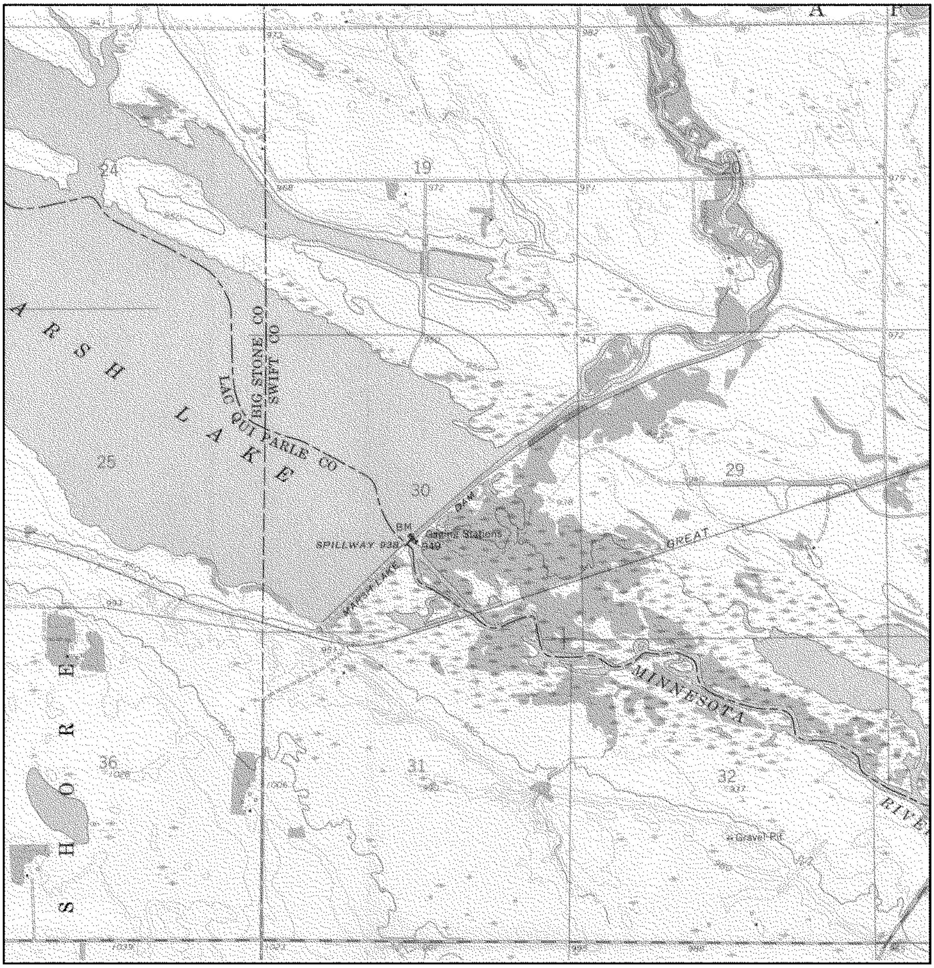
440 Wheelers Farms Road
Milford, CT 06461
800.352.0050
www.edrnet.com

EDR Historical Topographic Map Report

Environmental Data Resources, Inc.s (EDR) Historical Topographic Map Report is designed to assist professionals in evaluating potential liability on a target property resulting from past activities. EDRs Historical Topographic Map Report includes a search of a collection of public and private color historical topographic maps, dating back to the early 1900s.

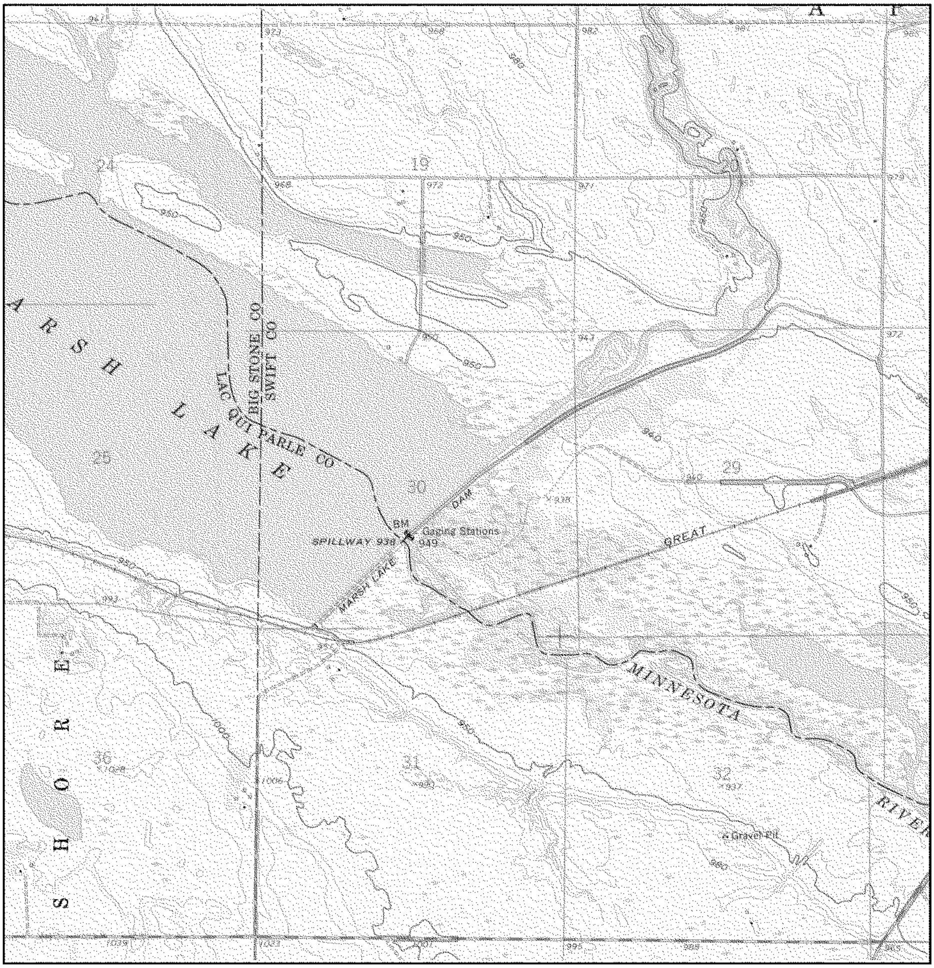
Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

Historical Topographic Map



N ↑	TARGET QUAD NAME: APPLETON MAP YEAR: 1958 SERIES: 7.5 SCALE: 1:24000	SITE NAME: Marsh Lake ADDRESS: Louisburg Road Appleton, MN 56208 LAT/LONG: 45.1739 / -96.0897	CLIENT: Army Corp of Engineers CONTACT: Ellen Engberg INQUIRY#: 3028253.4 RESEARCH DATE: 03/31/2011

Historical Topographic Map



N ↑	TARGET QUAD NAME: APPLETON MAP YEAR: 1977 PHOTOINSPECTED: 1958 SERIES: 7.5 SCALE: 1:24000	SITE NAME: Marsh Lake ADDRESS: Louisburg Road Appleton, MN 56208 LAT/LONG: 45.1739 / -96.0897	CLIENT: Army Corp of Engineers CONTACT: Ellen Engberg INQUIRY#: 3028253.4 RESEARCH DATE: 03/31/2011

Louisburg Road
Louisburg Road
Correll, MN 56227

Inquiry Number: 3028253.12
March 31, 2011

EDR Historical Topographic Map Report

EDR® Environmental Data Resources Inc

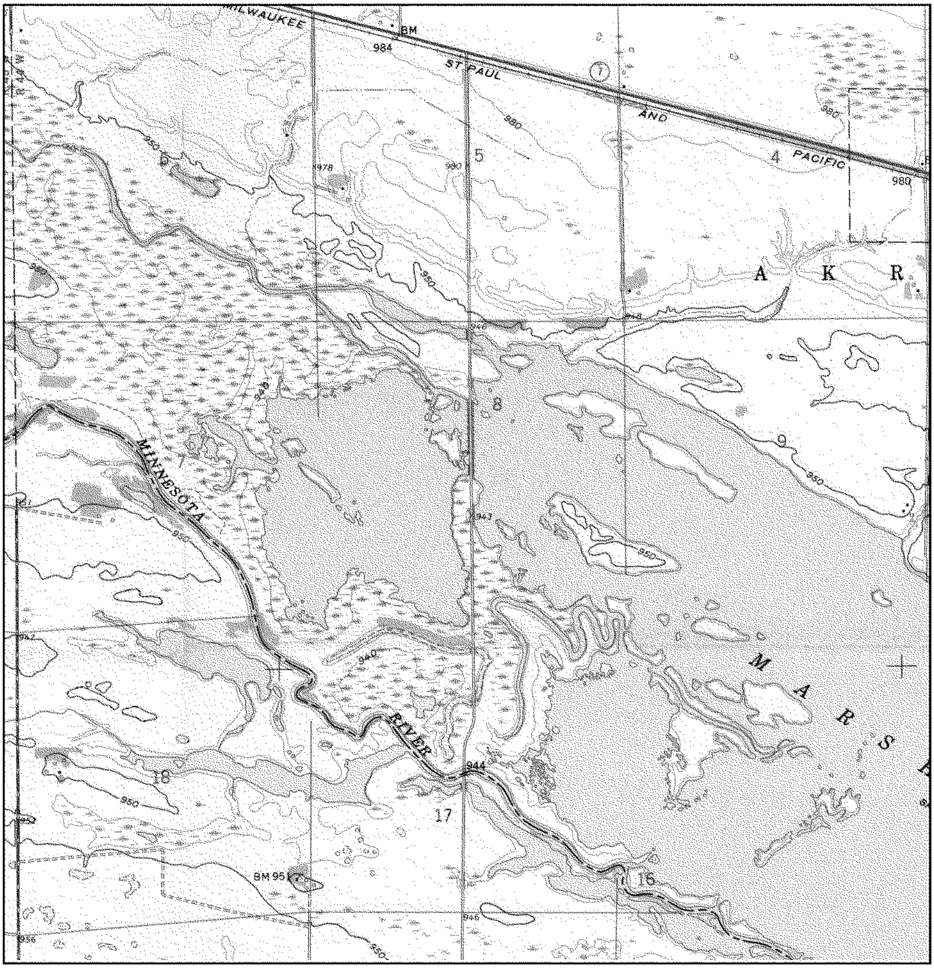
440 Wheelers Farms Road
Milford, CT 06461
800.352.0050
www.edrnet.com

EDR Historical Topographic Map Report

Environmental Data Resources, Inc.s (EDR) Historical Topographic Map Report is designed to assist professionals in evaluating potential liability on a target property resulting from past activities. EDRs Historical Topographic Map Report includes a search of a collection of public and private color historical topographic maps, dating back to the early 1900s.

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

Historical Topographic Map



N	TARGET QUAD		SITE NAME:	Louisburg Road	CLIENT:	Army Corp of Engineers
	NAME:	CORRELL	ADDRESS:	Louisburg Road	CONTACT:	Ellen Engberg
	MAP YEAR:	1958		Correll, MN 56227	INQUIRY#:	3028253.12
			LAT/LONG:	45.2169 / -96.1957	RESEARCH DATE:	03/31/2011
	SERIES:	7.5				
	SCALE:	1:24000				

Appendix F4

EDR Aerial Photo Reports

Marsh Lake Dam
Marsh Lake
Madison, MN 56256

Inquiry Number: 2627945.5
November 04, 2009

The EDR Aerial Photo Decade Package

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
800.352.0050
www.edrnet.com

EDR Aerial Photo Decade Package

Environmental Data Resources, Inc. (EDR) Aerial Photo Decade Package is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDRs professional researchers provide digitally reproduced historical aerial photographs, and when available, provide one photo per decade.

When delivered electronically by EDR, the aerial photo images included with this report are for ONE TIME USE ONLY. Further reproduction of these aerial photo images is prohibited without permission from EDR. For more information contact your EDR Account Executive.

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

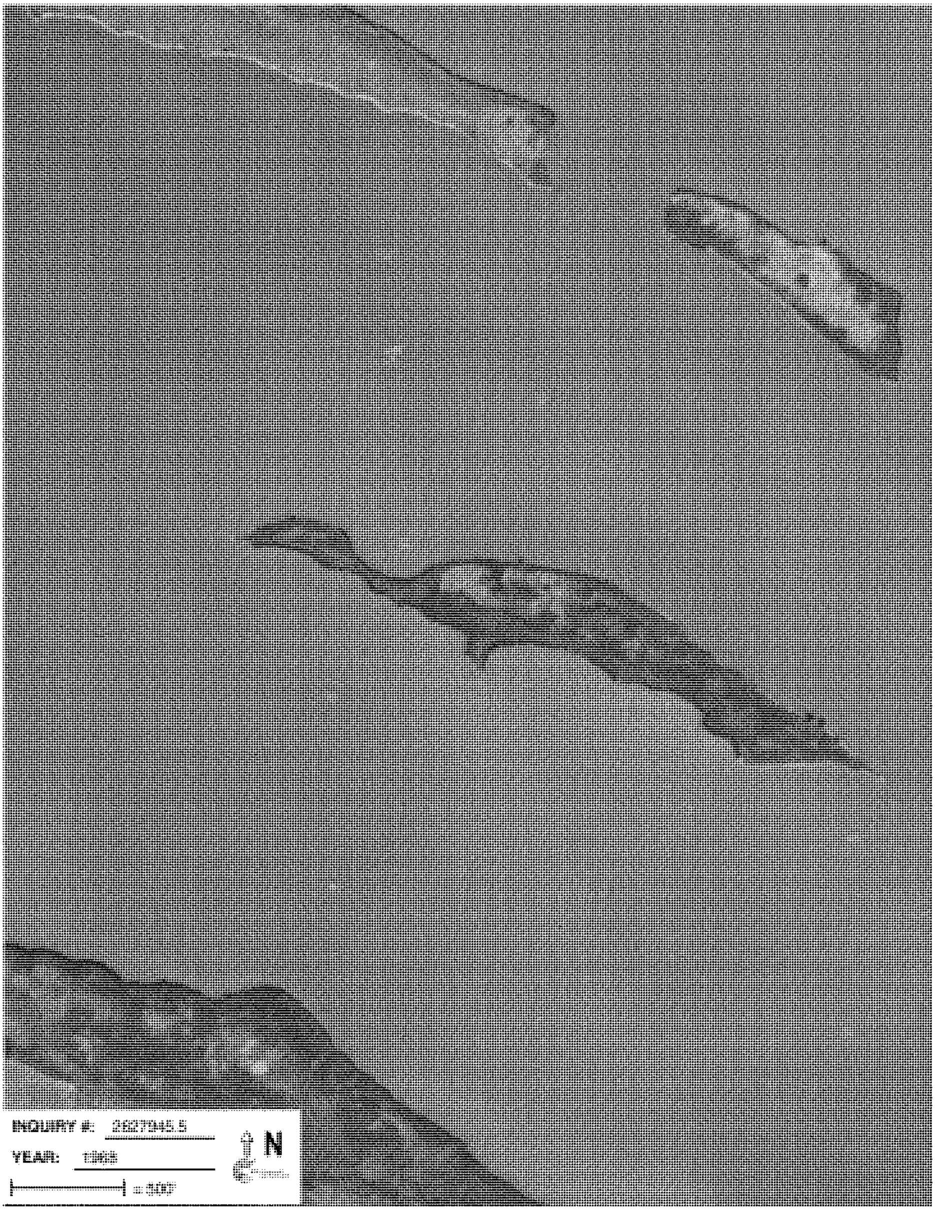
Date EDR Searched Historical Sources:
Aerial Photography November 04, 2009

Target Property:
Marsh Lake
Madison, MN 56256

Year	*Scale*	*Details*	*Source*
1938	Aerial Photograph. Scale: 1"=500'	Flight Year: 1938 Best Copy Available from original source	ASCS
1955	Aerial Photograph. Scale: 1"=500'	Flight Year: 1955 Best Copy Available from original source	ASCS
1968	Aerial Photograph. Scale: 1"=500'	Flight Year: 1968	ASCS
1991	Aerial Photograph. Scale: 1"=500'	Flight Year: 1991	NAPP
1996	Aerial Photograph. Scale: 1"=500'	Flight Year: 1996	NAPP
2005	Aerial Photograph. 1" = 604'	Flight Year: 2005	EDR
2006	Aerial Photograph. 1" = 604'	Flight Year: 2006	EDR


INQUIRY #: 2627945.5
YEAR:
N


INQUIRY #: 2627945.5
YEAR:
N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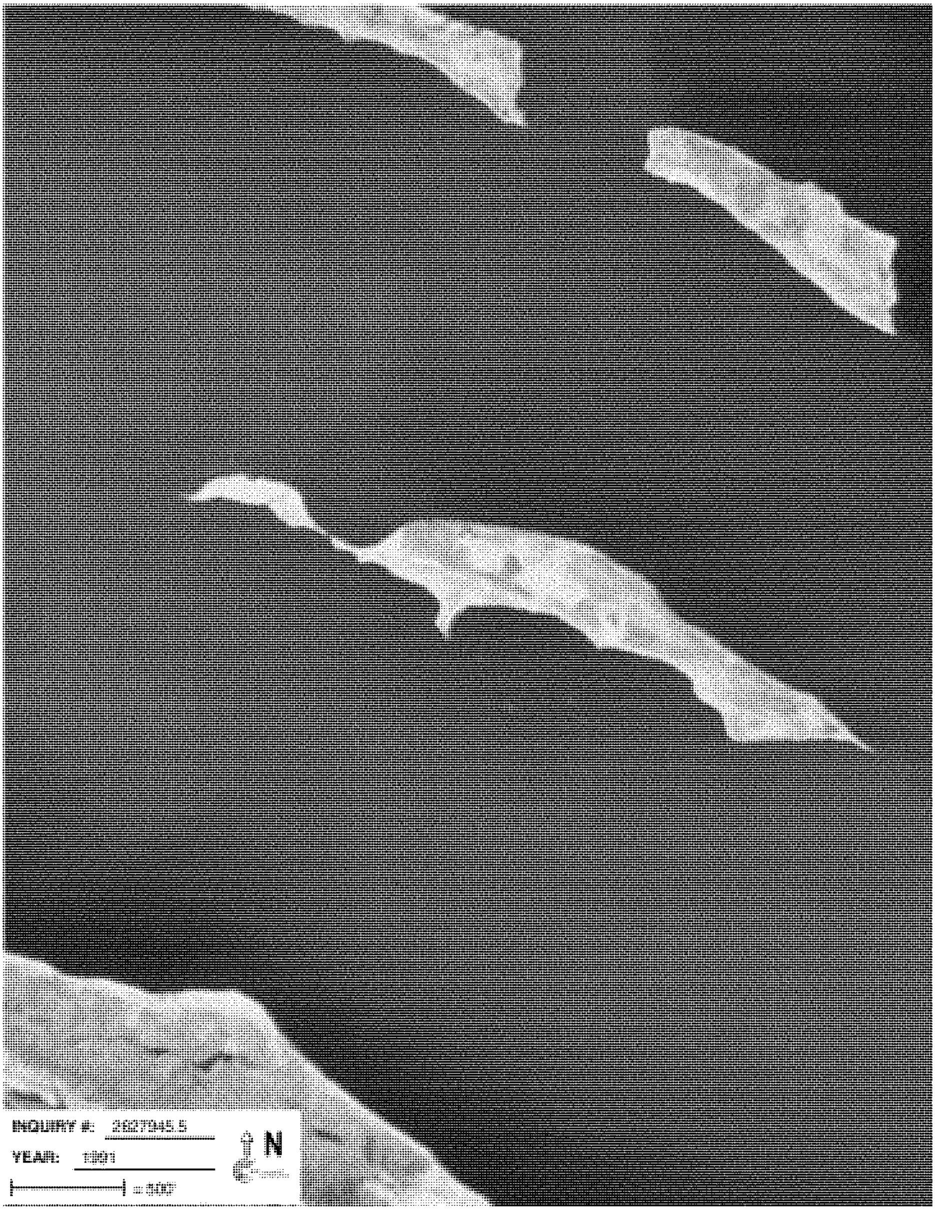
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INQUIRY #:
YEAR:
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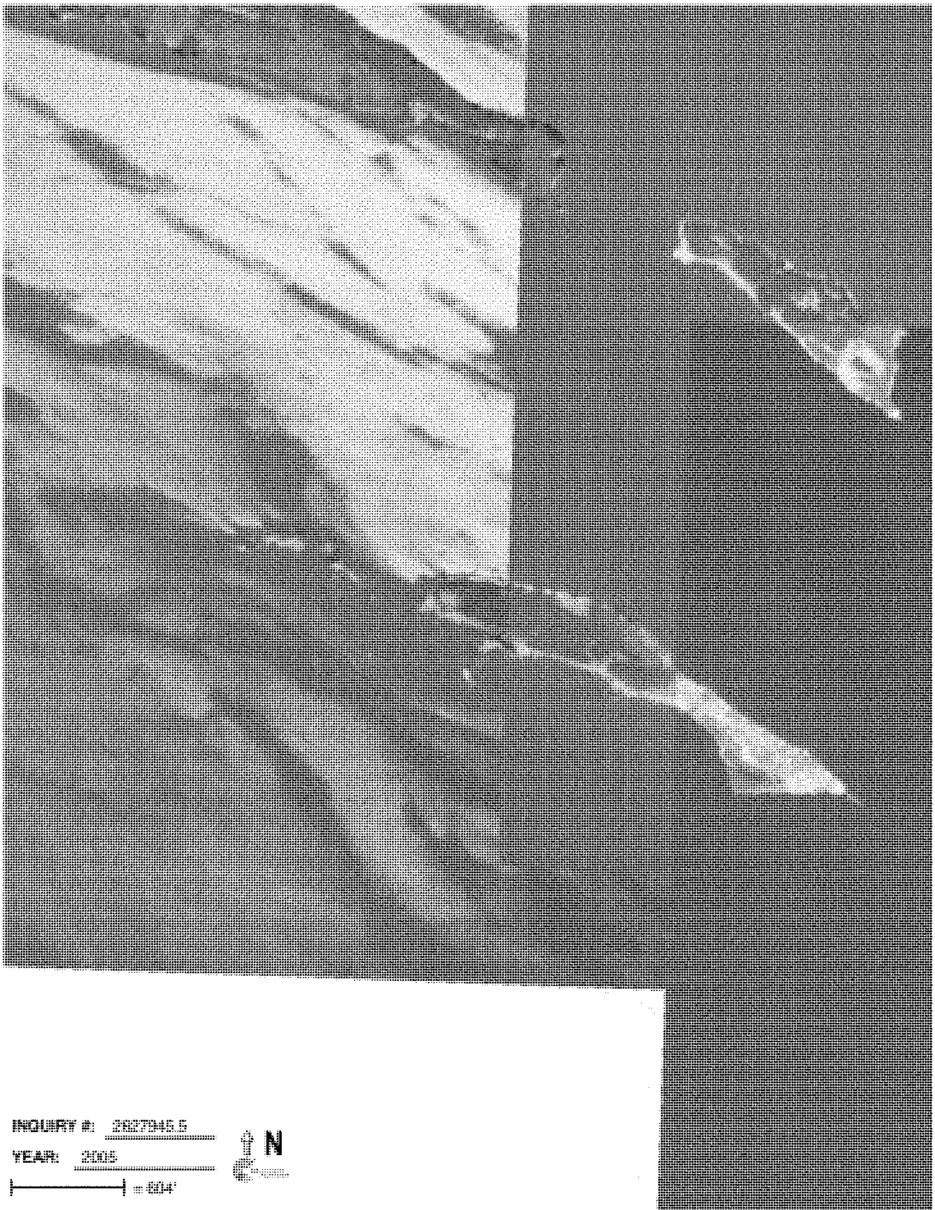
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YEAR: 2005
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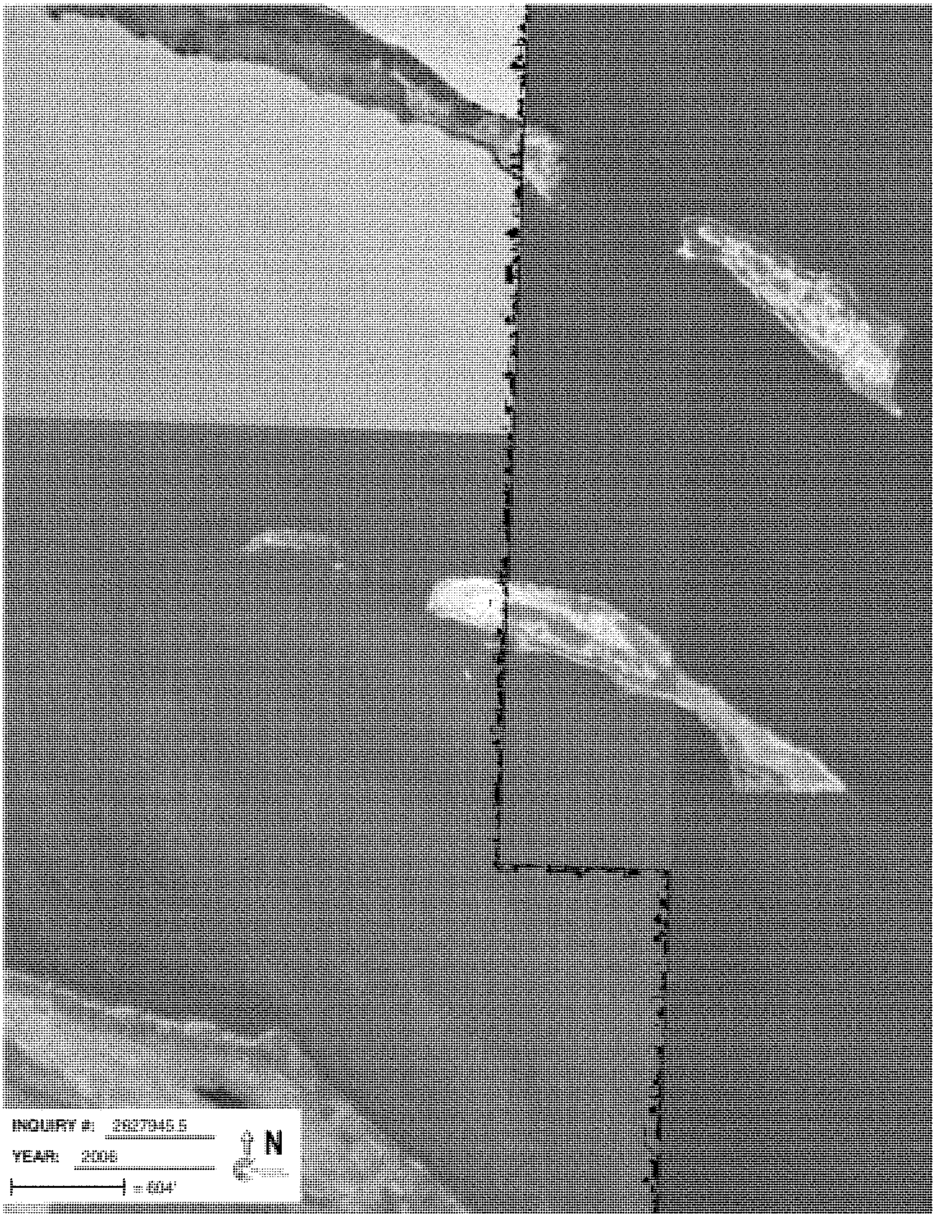

INQUIRY #:
YEAR:
N

Appendix F5

EDR Radius Map Reports

Marsh Lake
Louisburg Road
Appleton, MN 56208

Inquiry Number: 3028253.2s
March 31, 2011

The EDR Radius Map™ Report with GeoCheck®

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
Toll Free: 800.352.0050
www.edrnet.com

FORM-PST-TIB

TABLE OF CONTENTS

SECTION **PAGE**

GEOCHECK ADDENDUM

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-05) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

LOUISBURG ROAD
APPLETON, MN 56208

COORDINATES

Latitude (North):	45.173900 - 45˚ 10' 26.0"
Longitude (West):	96.089700 - 96˚ 5' 22.9"
Universal Tranverse Mercator:	Zone 14
UTM X (Meters):	728687.6
UTM Y (Meters):	5006172.5
Elevation:	939 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	45096-B1 APPLETON, MN
Most Recent Revision:	1977

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL........................... National Priority List
Proposed NPL................ Proposed National Priority List Sites
NPL LIENS.................... Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL................ National Priority List Deletions

EXECUTIVE SUMMARY

Federal CERCLIS list

CERCLIS........................ Comprehensive Environmental Response, Compensation, and Liability Information System
FEDERAL FACILITY............ Federal Facility Site Information listing

Federal CERCLIS NFRAP site List

CERC-NFRAP.................. CERCLIS No Further Remedial Action Planned

Federal RCRA CORRACTS facilities list

CORRACTS.................... Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF.................... RCRA - Treatment, Storage and Disposal

Federal RCRA generators list

RCRA-LQG..................... RCRA - Large Quantity Generators
RCRA-SQG..................... RCRA - Small Quantity Generators
RCRA-CESQG................. RCRA - Conditionally Exempt Small Quantity Generator

Federal institutional controls / engineering controls registries

US ENG CONTROLS.......... Engineering Controls Sites List
US INST CONTROL........... Sites with Institutional Controls

Federal ERNS list

ERNS............................ Emergency Response Notification System

State- and tribal - equivalent NPL

MN PLP.......................... Permanent List of Priorities

State- and tribal - equivalent CERCLIS

SHWS............................ Superfund Site Information Listing

State and tribal landfill and/or solid waste disposal site lists

SWF/LF.......................... Permitted Solid Waste Disposal Facilities
LCP............................... Closed Landfills Priority List
UNPERM LF.................... Unpermitted Facilities

State and tribal leaking storage tank lists

LUST............................. Leak Sites
LAST............................. Leaking Aboveground Storage Tanks
INDIAN LUST.................. Leaking Underground Storage Tanks on Indian Land

State and tribal registered storage tank lists

UST.............................. Underground Storage Tank Database

EXECUTIVE SUMMARY

AST........................... Aboveground Storage Tanks
INDIAN UST.................... Underground Storage Tanks on Indian Land
FEMA UST...................... Underground Storage Tank Listing

State and tribal institutional control / engineering control registries

INST CONTROL.................. Site Remediation Section Database

State and tribal voluntary cleanup sites

VIC........................... Voluntary Investigation and Cleanup Program
INDIAN VCP.................... Voluntary Cleanup Priority Listing

State and tribal Brownfields sites

BROWNFIELDS................... Petroleum Brownfields Program Sites

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS................ A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

ODI........................... Open Dump Inventory
DEBRIS REGION 9............... Torres Martinez Reservation Illegal Dump Site Locations
SWRCY......................... Recycling Facilities
INDIAN ODI.................... Report on the Status of Open Dumps on Indian Lands

Local Lists of Hazardous waste / Contaminated Sites

US CDL........................ Clandestine Drug Labs
SRS........................... Site Remediation Section Database
MN DEL PLP.................... Delisted Permanent List of Priorities
CDL........................... Clandestine Drug Labs
US HIST CDL................... National Clandestine Laboratory Register

Local Land Records

LIENS 2....................... CERCLA Lien Information
LUCIS......................... Land Use Control Information System
LIENS......................... Environmental Liens

Records of Emergency Release Reports

HMIRS......................... Hazardous Materials Information Reporting System
SPILLS........................ Spills Database
AGSPILLS...................... Department of Agriculture Spills

Other Ascertainable Records

RCRA-NonGen................... RCRA - Non Generators
DOT OPS....................... Incident and Accident Data

EXECUTIVE SUMMARY

FUDS	Formerly Used Defense Sites
CONSENT	Superfund (CERCLA) Consent Decrees
ROD	Records Of Decision
UMTRA	Uranium Mill Tailings Sites
MINES	Mines Master Index File
TRIS	Toxic Chemical Release Inventory System
TSCA	Toxic Substances Control Act
FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing
SSTS	Section 7 Tracking Systems
ICIS	Integrated Compliance Information System
PADS	PCB Activity Database System
MLTS	Material Licensing Tracking System
RADINFO	Radiation Information Database
FINDS	Facility Index System/Facility Registry System
RAATS	RCRA Administrative Action Tracking System
MN LS	List of Sites
BULK	Bulk Facilities Database
MANIFEST	Hazardous Waste Manifest Data
DRYCLEANERS	Registered Drycleaning Facilities
ENF	Generators Associated with Enforcement Logs
MN HWS Permit	Active TSD Facilities
AIRS	Permit Contact List
TIER 2	Tier 2 Facility Listing
INDIAN RESERV	Indian Reservations
SCRD DRYCLEANERS	State Coalition for Remediation of Drycleaners Listing
PCB TRANSFORMER	PCB Transformer Registration Database
COAL ASH EPA	Coal Combustion Residues Surface Impoundments List
COAL ASH DOE	Sleam-Electric Plan Operation Data
MDA LIS	Licensing Information System Database Listing
AGVIC	Agricultural Voluntary Investigation & Cleanup Listing
WIMN	What's In My Neighborhood
COAL ASH	Coal Ash Disposal Site Listing

EDR PROPRIETARY RECORDS

EDR Proprietary Records

Manufactured Gas Plants	EDR Proprietary Manufactured Gas Plants

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

EXECUTIVE SUMMARY

ADDITIONAL ENVIRONMENTAL RECORDS

Other Ascertainable Records

DOD: Consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

A review of the DOD list, as provided by EDR, and dated 12/31/2005 has revealed that there is 1 DOD site within approximately 1.5 miles of the target property.

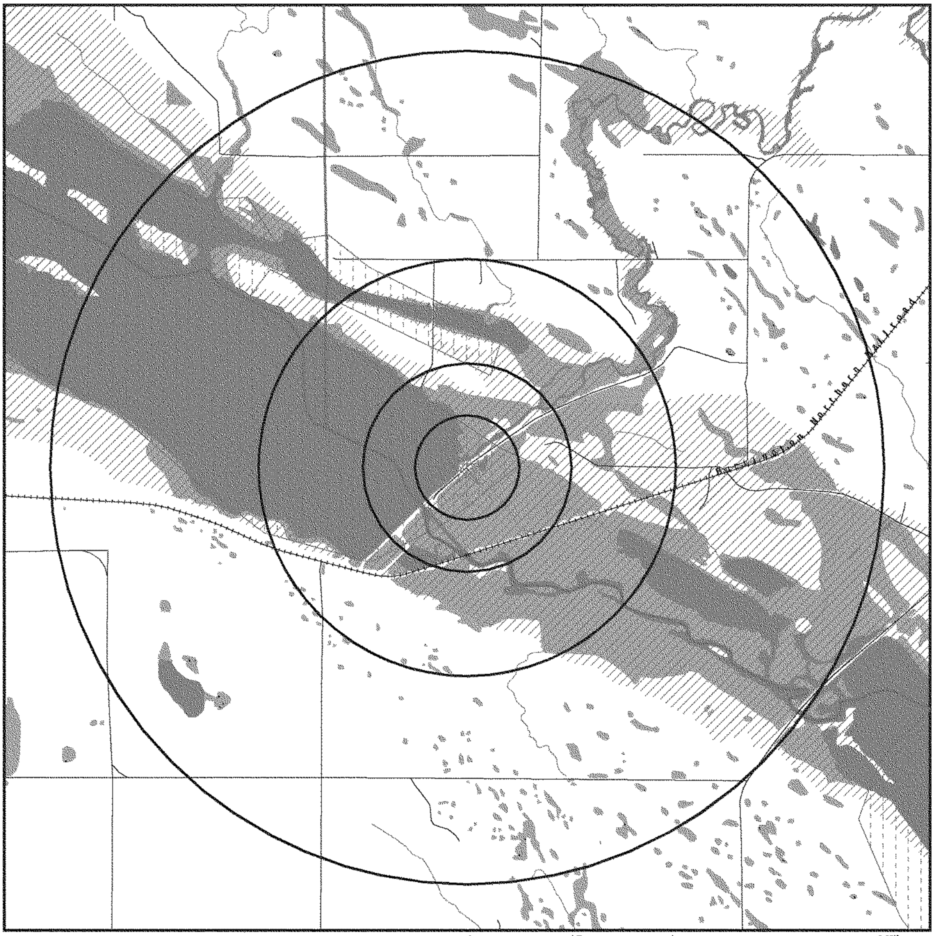
Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
MASH LAKE		0 - 1/8 (0.000 mi.)	0	7

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped. Count: 40 records.

Site Name	Database(s)
LAC QUI PARLE SCHOOL BUS GARAGE	WIMN
FIEDLER FAMILY FARM APPLETON BARN	WIMN
APPLETON BUS GARAGE	AST,UST,WIMN
GERALD GIESE FARM	WIMN
DANIEL STRUXNESS FARM - SEC 27	WIMN
RANDY FRAGODT FARM - SEC 26	WIMN
RON'S SERVICE CENTER	WIMN
J & J AMOCO	WIMN
ASCHEMAN OIL - APPLETON	WIMN
VIVIAN KELLER RESIDENCE	WIMN
CORRELL CITY OF - SW	WIMN
HARVEY HASTAD FARM - SEC 8	WIMN
MIKE KEMEN FARM - SEC 21	WIMN
ROBERT GOERGER FARM - SEC 17	WIMN
ROBERT LUDVIGSON FARM - SEC 11	WIMN
DALE KEMEN FARM - SEC 22	WIMN
RODNEY WEBER FARM - SEC 21	WIMN
THEO NELSON - MAKIN BACON FARM	WIMN
LARRY CLARK FARM - SEC 22	WIMN
A FRAME FARM - SEC 22	WIMN
SCHMIEG OIL CO	WIMN
MNDOT TRUCK STATION	WIMN
RANDY & TODD MORTENSON FARM	WIMN
MADISON GAS & GRUB	WIMN
LUND IMPLEMENT CO	WIMN
JAMES HEGLAND	MDA LIS
RANDY ASCHEMAN	MDA LIS
LAC QUI PARLE SCHOOL BUS GARAGE	LUST
J & J AMOCO	LUST
MNDOT TRUCK STATION	AST,UST
MADISON GAS & GRUB	UST
VIVIAN KELLER RESIDENCE	LAST,SPILLS
SCHMIEG OIL CO	AST
RICHARD LARSON DBA LARSON AUTO BOD	RCRA-CESQG
WESTERN CONSOLIDATED COOPERATIVE	BULK
THOMPSON CHUCK DBA FARM ADVANTAGE	BULK
CITY OF APPLETON WASTEWATER FACILI	TIER 2
GLACIAL PLAINS COOP - LP PLANT	TIER 2
MNDOT	TIER 2
LAC QUI PARLE COOP OIL	TIER 2

OVERVIEW MAP - 3028253.2s

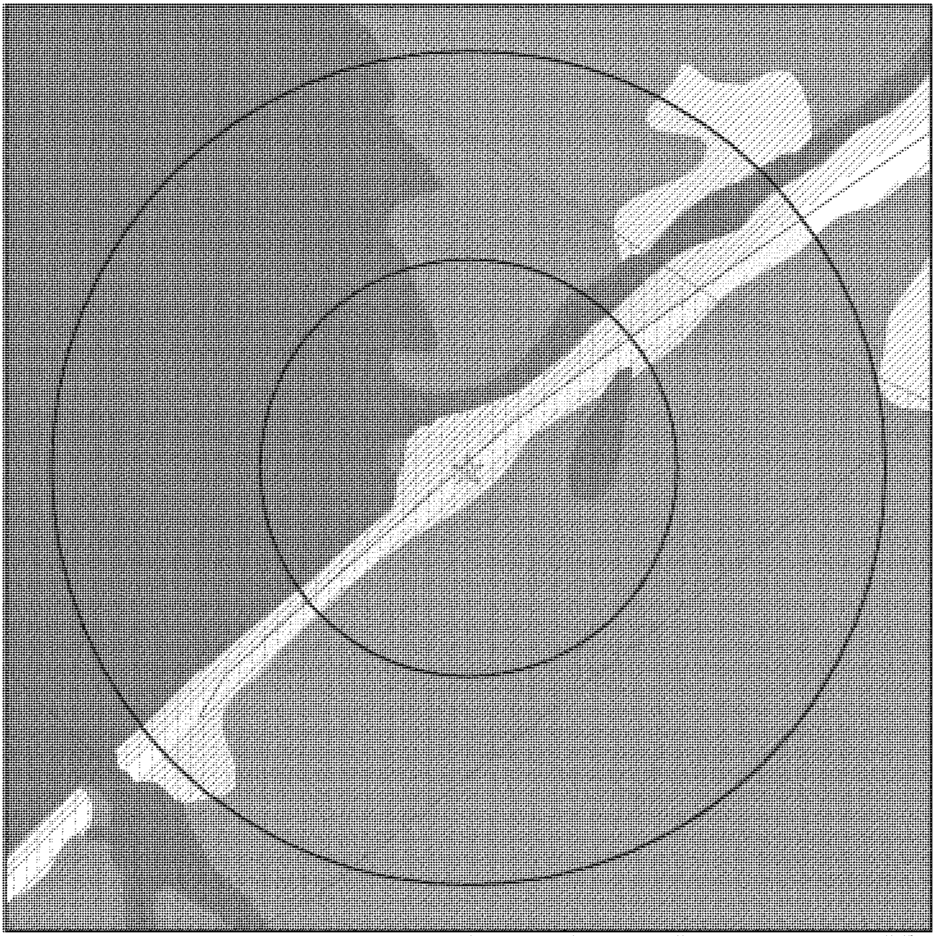


0 1/2 1 2 Miles

- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- County Boundary
- Oil & Gas pipelines
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory

SITE NAME:	Marsh Lake	CLIENT:	Army Corp of Engineers
ADDRESS:	Louisburg Road Appleton MN 56208	CONTACT:	Ellen Engberg
		INQUIRY #:	3028253.2s
LAT/LONG:	45.1739 / 96.0897	DATE:	March 31, 2011 1:49 pm

DETAIL MAP - 3028253.2s



0 1/16 1/8 1/4 Miles

- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- County Boundary
- Oil & Gas pipelines
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory

SITE NAME:	Marsh Lake	CLIENT:	Army Corp of Engineers
ADDRESS:	Louisburg Road Appleton MN 56208	CONTACT:	Ellen Engberg
		INQUIRY #:	3028253.2s
LAT/LONG:	45.1739 / 96.0897	DATE:	March 31, 2011 1:50 pm

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL		1.500	0	0	0	0	0	0
Proposed NPL		1.500	0	0	0	0	0	0
NPL LIENS		0.500	0	0	0	NR	NR	0
Federal Delisted NPL site list								
Delisted NPL		1.500	0	0	0	0	0	0
Federal CERCLIS list								
CERCLIS		1.000	0	0	0	0	NR	0
FEDERAL FACILITY		1.500	0	0	0	0	0	0
Federal CERCLIS NFRAP site List								
CERC-NFRAP		1.000	0	0	0	0	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS		1.500	0	0	0	0	0	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF		1.000	0	0	0	0	NR	0
Federal RCRA generators list								
RCRA-LQG		0.750	0	0	0	0	NR	0
RCRA-SQG		0.750	0	0	0	0	NR	0
RCRA-CESQG		0.750	0	0	0	0	NR	0
Federal institutional controls / engineering controls registries								
US ENG CONTROLS		1.000	0	0	0	0	NR	0
US INST CONTROL		1.000	0	0	0	0	NR	0
Federal ERNS list								
ERNS		0.500	0	0	0	NR	NR	0
State- and tribal - equivalent NPL								
MN PLP		1.000	0	0	0	0	NR	0
State- and tribal - equivalent CERCLIS								
SHWS		1.500	0	0	0	0	0	0
State and tribal landfill and/or solid waste disposal site lists								
SWF/LF		1.000	0	0	0	0	NR	0
LCP		1.000	0	0	0	0	NR	0
UNPERM LF		1.000	0	0	0	0	NR	0
State and tribal leaking storage tank lists								
LUST		1.000	0	0	0	0	NR	0

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
LAST		1.000	0	0	0	0	NR	0
INDIAN LUST		1.000	0	0	0	0	NR	0
State and tribal registered storage tank lists								
UST		0.750	0	0	0	0	NR	0
AST		0.750	0	0	0	0	NR	0
INDIAN UST		0.750	0	0	0	0	NR	0
FEMA UST		0.750	0	0	0	0	NR	0
State and tribal institutional control / engineering control registries								
INST CONTROL		1.000	0	0	0	0	NR	0
State and tribal voluntary cleanup sites								
VIC		1.000	0	0	0	0	NR	0
INDIAN VCP		1.000	0	0	0	0	NR	0
State and tribal Brownfields sites								
BROWNFIELDS		1.000	0	0	0	0	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS		1.000	0	0	0	0	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
ODI		1.000	0	0	0	0	NR	0
DEBRIS REGION 9		1.000	0	0	0	0	NR	0
SWRCY		1.000	0	0	0	0	NR	0
INDIAN ODI		1.000	0	0	0	0	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US CDL		0.500	0	0	0	NR	NR	0
SRS		0.500	0	0	0	NR	NR	0
MN DEL PLP		1.000	0	0	0	0	NR	0
CDL		0.500	0	0	0	NR	NR	0
US HIST CDL		0.500	0	0	0	NR	NR	0
Local Land Records								
LIENS 2		0.500	0	0	0	NR	NR	0
LUCIS		1.000	0	0	0	0	NR	0
LIENS		0.500	0	0	0	NR	NR	0
Records of Emergency Release Reports								
HMIRS		0.500	0	0	0	NR	NR	0
SPILLS		0.500	0	0	0	NR	NR	0
AGSPILLS		0.500	0	0	0	NR	NR	0
Other Ascertainable Records								
RCRA-NonGen		0.750	0	0	0	0	NR	0

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
DOT OPS		0.500	0	0	0	NR	NR	0
DOD		1.500	1	0	0	0	0	1
FUDS		1.500	0	0	0	0	0	0
CONSENT		1.500	0	0	0	0	0	0
ROD		1.500	0	0	0	0	0	0
UMTRA		1.000	0	0	0	0	NR	0
MINES		0.750	0	0	0	0	NR	0
TRIS		0.500	0	0	0	NR	NR	0
TSCA		0.500	0	0	0	NR	NR	0
FTTS		0.500	0	0	0	NR	NR	0
HIST FTTS		0.500	0	0	0	NR	NR	0
SSTS		0.500	0	0	0	NR	NR	0
ICIS		0.500	0	0	0	NR	NR	0
PADS		0.500	0	0	0	NR	NR	0
MLTS		0.500	0	0	0	NR	NR	0
RADINFO		0.500	0	0	0	NR	NR	0
FINDS		0.500	0	0	0	NR	NR	0
RAATS		0.500	0	0	0	NR	NR	0
MN LS		1.000	0	0	0	0	NR	0
BULK		0.750	0	0	0	0	NR	0
MANIFEST		0.750	0	0	0	0	NR	0
DRYCLEANERS		0.750	0	0	0	0	NR	0
ENF		0.500	0	0	0	NR	NR	0
MN HWS Permit		1.500	0	0	0	0	0	0
AIRS		0.500	0	0	0	NR	NR	0
TIER 2		0.500	0	0	0	NR	NR	0
INDIAN RESERV		1.500	0	0	0	0	0	0
SCRD DRYCLEANERS		1.000	0	0	0	0	NR	0
PCB TRANSFORMER		0.500	0	0	0	NR	NR	0
COAL ASH EPA		1.000	0	0	0	0	NR	0
COAL ASH DOE		0.500	0	0	0	NR	NR	0
MDA LIS		0.250	0	0	NR	NR	NR	0
AGVIC		1.000	0	0	0	0	NR	0
WIMN		1.000	0	0	0	0	NR	0
COAL ASH		1.000	0	0	0	0	NR	0

EDR PROPRIETARY RECORDS

EDR Proprietary Records

Manufactured Gas Plants		1.500	0	0	0	0	0	0

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

MAP FINDINGS

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number
DOD Region < 1/8 1 ft.	**MASH LAKE** **MASH LAKE (County), MN**	**DOD**	**CUSA103642** **N/A**

DOD:

Feature 1:	Army Corps of Engineers DOD
Feature 2:	Not reported
Feature 3:	Not reported
URL:	Not reported
Name 1:	Mash Lake
Name 2:	Not reported
Name 3:	Not reported
State:	MN
DOD Site:	Yes
Tile name:	MNBIG_STONE

Count: 40 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
MADISON	1012211489	RICHARD LARSON DBA LARSON AUTO BOD	2356 HIGHWAY 75 S	56256	RCRA-CESOG
MADISON	A100026233	SCHMIEG OIL CO	HIGHWAY 40	56256	AST
APPLETON	S106348201	VIVIAN KELLER RESIDENCE	GUNDERSON & HIGHWAY 7		LAST,SPILLS
APPLETON	S106551299	LAC QUI PARLE SCHOOL BUS GARAGE	HIGHWAY 119 S		LUST
APPLETON	S106551905	J & J AMOCO	HIGHWAY 7 & HIGHWAY 59		LUST
MADISON	S107413285	THOMPSON CHUCK DBA FARM ADVANTAGE	1778 HWY 212	56256	BULK
APPLETON	S107727966	CITY OF APPLETON WASTEWATER FACILI	HWY 7 WEST	56208	TIER 2
APPLETON	S107729214	GLACIAL PLAINS COOP - LP PLANT	HWY 7 W	56208	TIER 2
MADISON	S107729877	LAC QUI PARLE COOP OIL	HWY 75 & HWY 40	56256	TIER 2
MADISON	S107730445	MNDOT	HWY 40 E	56256	TIER 2
APPLETON	S108411969	WESTERN CONSOLIDATED COOPERATIVE	NORTH HWY 59	56208	BULK
APPLETON	S109056542	JAMES HEGLAND	RTE 3 BOX 63	56208	MDA LIS
	S109057460	RANDY ASCHEMAN	HWY 12		MDA LIS
APPLETON	S110180791	ASCHEMAN OIL - APPLETON	HIGHWAY 7	56208	WIMN
MADISON	S110186108	RANDY & TODD MORTENSON FARM	1596 HIGHWAY 40	56256	WIMN
CORRELL	S110187400	CORRELL CITY OF - SW	119 HIGHWAY 7 E	56227	WIMN
MADISON	S110189042	DALE KEMEN FARM - SEC 22	2495 HIGHWAY 212	56256	WIMN
APPLETON	S110199273	GERALD GIESE FARM	2290 HIGHWAY 12 SW	56208	WIMN
MADISON	S110201656	HARVEY HASTAD FARM - SEC 8	3223 HIGHWAY 119	56256	WIMN
MADISON	S110214030	LUND IMPLEMENT CO	HIGHWAY 75 N	56256	WIMN
APPLETON	S110224239	RANDY FRAGODT FARM - SEC 26	3154 HIGHWAY 40	56208	WIMN
MADISON	S110226798	ROBERT LUDVIGSON FARM - SEC 11	1979 HIGHWAY 212	56256	WIMN
MADISON	S110227351	RODNEY WEBER FARM - SEC 21	1880 HIGHWAY 212	56256	WIMN
APPLETON	S110228164	RON'S SERVICE CENTER	HIGHWAY 59 E & HIGHWAY 7	56208	WIMN
APPLETON	S110433907	J & J AMOCO	HIGHWAY 7 & HIGHWAY 59	56208	WIMN
APPLETON	S110434910	LAC QUI PARLE SCHOOL BUS GARAGE	HIGHWAY 119 S	56208	WIMN
MADISON	S110435869	MADISON GAS & GRUB	HIGHWAY 75 & 40	56256	WIMN
MADISON	S110437043	MNDOT TRUCK STATION	HIGHWAY 40 E	56256	WIMN
MADISON	S110440655	SCHMIEG OIL CO	HIGHWAY 40	56256	WIMN
MADISON	S110442903	THEO NELSON - MAKIN BACON FARM	2199 HIGHWAY 2L2	56256	WIMN
APPLETON	S110443778	VIVIAN KELLER RESIDENCE	GUNDERSON & HIGHWAY 7	56208	WIMN
MADISON	S110594173	A FRAME FARM - SEC 22	2484 HIGHWAY 40	56256	WIMN
APPLETON	S110594597	DANIEL STRUXNESS FARM - SEC 27	3034 HIGHWAY 40	56208	WIMN
APPLETON	S110594806	FIEDLER FAMILY FARM APPLETON BARN	55100 HIGHWAY 119 SW	56208	WIMN
MADISON	S110595302	LARRY CLARK FARM - SEC 22	1884 HIGHWAY 40	56256	WIMN
MADISON	S110595475	MIKE KEMEN FARM - SEC 21	2375 HIGHWAY 212	56256	WIMN
MADISON	S110595818	ROBERT GOERGER FARM - SEC 17	2232 HIGHWAY 212	56256	WIMN
APPLETON	U003851795	APPLETON BUS GARAGE	HIGHWAY 119	56208	AST,UST,WIMN
MADISON	U003961465	MNDOT TRUCK STATION	HIGHWAY 40 E	56256	AST,UST
MADISON	U004016829	MADISON GAS & GRUB	HIGHWAY 75 & 40	56256	UST

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List
National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 12/31/2010
Date Data Arrived at EDR: 01/13/2011
Date Made Active in Reports: 01/28/2011
Number of Days to Update: 15

Source: EPA
Telephone: N/A
Last EDR Contact: 01/13/2011
Next Scheduled EDR Contact: 04/25/2011
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 3
Telephone 215-814-5418

EPA Region 4
Telephone 404-562-8033

EPA Region 5
Telephone 312-886-6686

EPA Region 10
Telephone 206-553-8665

EPA Region 6
Telephone: 214-655-6659

EPA Region 7
Telephone: 913-551-7247

EPA Region 8
Telephone: 303-312-6774

EPA Region 9
Telephone: 415-947-4246

Proposed NPL: Proposed National Priority List Sites
A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 12/31/2010
Date Data Arrived at EDR: 01/13/2011
Date Made Active in Reports: 01/28/2011
Number of Days to Update: 15

Source: EPA
Telephone: N/A
Last EDR Contact: 01/13/2011
Next Scheduled EDR Contact: 04/25/2011
Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens
Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 02/14/2011
Next Scheduled EDR Contact: 05/30/2011
Data Release Frequency: No Update Planned

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Federal Delisted NPL site list

DELISTED NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 12/31/2010	Source: EPA
Date Data Arrived at EDR: 01/13/2011	Telephone: N/A
Date Made Active in Reports: 01/28/2011	Last EDR Contact: 01/13/2011
Number of Days to Update: 15	Next Scheduled EDR Contact: 04/25/2011
	Data Release Frequency: Quarterly

Federal CERCLIS list

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System

CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 11/30/2010	Source: EPA
Date Data Arrived at EDR: 12/30/2010	Telephone: 703-412-9810
Date Made Active in Reports: 02/25/2011	Last EDR Contact: 03/01/2011
Number of Days to Update: 57	Next Scheduled EDR Contact: 06/13/2011
	Data Release Frequency: Quarterly

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPAa??s Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 12/10/2010	Source: Environmental Protection Agency
Date Data Arrived at EDR: 01/11/2011	Telephone: 703-603-8704
Date Made Active in Reports: 02/16/2011	Last EDR Contact: 01/11/2011
Number of Days to Update: 36	Next Scheduled EDR Contact: 04/25/2011
	Data Release Frequency: Varies

Federal CERCLIS NFRAP site List

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned

Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Date of Government Version: 10/28/2010	Source: EPA
Date Data Arrived at EDR: 12/01/2010	Telephone: 703-412-9810
Date Made Active in Reports: 02/25/2011	Last EDR Contact: 03/01/2011
Number of Days to Update: 86	Next Scheduled EDR Contact: 06/13/2011
	Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 05/25/2010	Source: EPA
Date Data Arrived at EDR: 06/02/2010	Telephone: 800-424-9346
Date Made Active in Reports: 10/04/2010	Last EDR Contact: 02/14/2011
Number of Days to Update: 124	Next Scheduled EDR Contact: 05/30/2011
	Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 02/17/2010	Source: Environmental Protection Agency
Date Data Arrived at EDR: 02/19/2010	Telephone: 312-886-6186
Date Made Active in Reports: 05/17/2010	Last EDR Contact: 01/06/2011
Number of Days to Update: 87	Next Scheduled EDR Contact: 04/18/2011
	Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 02/17/2010	Source: Environmental Protection Agency
Date Data Arrived at EDR: 02/19/2010	Telephone: 312-886-6186
Date Made Active in Reports: 05/17/2010	Last EDR Contact: 01/06/2011
Number of Days to Update: 87	Next Scheduled EDR Contact: 04/18/2011
	Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 02/17/2010	Source: Environmental Protection Agency
Date Data Arrived at EDR: 02/19/2010	Telephone: 312-886-6186
Date Made Active in Reports: 05/17/2010	Last EDR Contact: 01/06/2011
Number of Days to Update: 87	Next Scheduled EDR Contact: 04/18/2011
	Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 02/17/2010	Source: Environmental Protection Agency
Date Data Arrived at EDR: 02/19/2010	Telephone: 312-886-6186
Date Made Active in Reports: 05/17/2010	Last EDR Contact: 01/06/2011
Number of Days to Update: 87	Next Scheduled EDR Contact: 04/18/2011
	Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Federal institutional controls / engineering controls registries

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 01/05/2011	Source: Environmental Protection Agency
Date Data Arrived at EDR: 01/14/2011	Telephone: 703-603-0695
Date Made Active in Reports: 01/28/2011	Last EDR Contact: 03/14/2011
Number of Days to Update: 14	Next Scheduled EDR Contact: 06/27/2011
	Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 01/05/2011	Source: Environmental Protection Agency
Date Data Arrived at EDR: 01/14/2011	Telephone: 703-603-0695
Date Made Active in Reports: 01/28/2011	Last EDR Contact: 03/14/2011
Number of Days to Update: 14	Next Scheduled EDR Contact: 06/27/2011
	Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 12/31/2010	Source: National Response Center, United States Coast Guard
Date Data Arrived at EDR: 01/07/2011	Telephone: 202-267-2180
Date Made Active in Reports: 03/21/2011	Last EDR Contact: 01/07/2011
Number of Days to Update: 73	Next Scheduled EDR Contact: 04/18/2011
	Data Release Frequency: Annually

State- and tribal - equivalent NPL

MN PLP: Permanent List of Priorities

The list identifies hazardous waste sites where investigation and cleanup are needed, cleanup is underway, or cleanup has been completed and long-term monitoring or maintenance continues.

Date of Government Version: 08/01/2009	Source: Pollution Control Agency
Date Data Arrived at EDR: 12/16/2009	Telephone: 651-296-6139
Date Made Active in Reports: 01/13/2010	Last EDR Contact: 02/28/2011
Number of Days to Update: 28	Next Scheduled EDR Contact: 05/30/2011
	Data Release Frequency: Annually

State- and tribal - equivalent CERCLIS

SHWS: Superfund Site Information Listing

The SRS database includes all sites that the State Superfund Program is dealing with or has dealt with. The Superfund Program identifies, investigates and determines appropriate cleanup plans for abandoned or uncontrolled hazardous waste sites where a release or potential release of a hazardous substance poses a risk to human health or the environment.

Date of Government Version: 01/03/2011	Source: Minnesota Pollution Control Agency
Date Data Arrived at EDR: 01/06/2011	Telephone: 651-296-6300
Date Made Active in Reports: 02/02/2011	Last EDR Contact: 03/18/2011
Number of Days to Update: 27	Next Scheduled EDR Contact: 06/27/2011
	Data Release Frequency: Annually

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

State and tribal landfill and/or solid waste disposal site lists

SWF/LF: Permitted Solid Waste Disposal Facilities

Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 02/01/2011
Date Data Arrived at EDR: 02/15/2011
Date Made Active in Reports: 02/28/2011
Number of Days to Update: 13

Source: Minnesota Pollution Control Agency
Telephone: 651-296-7276
Last EDR Contact: 02/15/2011
Next Scheduled EDR Contact: 05/30/2011
Data Release Frequency: Varies

LCP: Closed Landfills Priority List

The Minnesota Legislature enacted a law to manage and clean up the state's closed Mixed Municipal Solid Waste Landfills. Under that law, the MPCA is required to create and periodically revise a priority list of qualified landfills, based on the relative health and environmental risks they present. The MPCA established the first such priority list in December, 1994.

Date of Government Version: 11/01/2009
Date Data Arrived at EDR: 01/08/2010
Date Made Active in Reports: 01/26/2010
Number of Days to Update: 18

Source: Minnesota Pollution Control Agency
Telephone: 651-296-9543
Source: Pollution Control Agency, GIS Section
Telephone: 651-296-7266
Last EDR Contact: 02/28/2011
Next Scheduled EDR Contact: 06/13/2011
Data Release Frequency: Annually

UNPERM LF: Unpermitted Facilities

These are facilities that have solid waste disposal yet are not permitted.

Date of Government Version: 02/01/2011
Date Data Arrived at EDR: 02/15/2011
Date Made Active in Reports: 02/28/2011
Number of Days to Update: 13

Source: Pollution Control Agency
Telephone: 651-757-2665
Last EDR Contact: 02/15/2011
Next Scheduled EDR Contact: 05/30/2011
Data Release Frequency: Quarterly

State and tribal leaking storage tank lists

LUST: Leak Sites

Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 11/01/2010
Date Data Arrived at EDR: 11/17/2010
Date Made Active in Reports: 11/30/2010
Number of Days to Update: 13

Source: Minnesota Pollution Control Agency
Telephone: 651-296-6300
Last EDR Contact: 03/23/2011
Next Scheduled EDR Contact: 05/30/2011
Data Release Frequency: Semi-Annually

LAST: Leaking Aboveground Storage Tanks

A listing of leaking aboveground storage tanks.

Date of Government Version: 11/01/2010
Date Data Arrived at EDR: 11/17/2010
Date Made Active in Reports: 11/30/2010
Number of Days to Update: 13

Source: Pollution Control Agency
Telephone: 651-296-6300
Last EDR Contact: 03/23/2011
Next Scheduled EDR Contact: 05/30/2011
Data Release Frequency: Semi-Annually

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 02/04/2011
Date Data Arrived at EDR: 02/04/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 45

Source: EPA Region 8
Telephone: 303-312-6271
Last EDR Contact: 01/31/2011
Next Scheduled EDR Contact: 05/16/2011
Data Release Frequency: Quarterly

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 11/04/2009
Date Data Arrived at EDR: 05/04/2010
Date Made Active in Reports: 07/07/2010
Number of Days to Update: 64

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 05/04/2010
Next Scheduled EDR Contact: 05/16/2011
Data Release Frequency: Varies

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 02/03/2011
Date Data Arrived at EDR: 02/04/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 45

Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 01/31/2011
Next Scheduled EDR Contact: 05/16/2011
Data Release Frequency: Varies

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 09/01/2010
Date Data Arrived at EDR: 11/05/2010
Date Made Active in Reports: 01/28/2011
Number of Days to Update: 84

Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 02/03/2011
Next Scheduled EDR Contact: 05/16/2011
Data Release Frequency: Varies

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 02/03/2011
Date Data Arrived at EDR: 02/04/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 45

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 01/31/2011
Next Scheduled EDR Contact: 05/16/2011
Data Release Frequency: Quarterly

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 01/31/2011
Date Data Arrived at EDR: 02/01/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 48

Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 01/31/2011
Next Scheduled EDR Contact: 05/16/2011
Data Release Frequency: Quarterly

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 08/27/2010
Date Data Arrived at EDR: 08/30/2010
Date Made Active in Reports: 10/04/2010
Number of Days to Update: 35

Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 02/16/2011
Next Scheduled EDR Contact: 05/16/2011
Data Release Frequency: Semi-Annually

State and tribal registered storage tank lists

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

UST: Underground Storage Tank Database
Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 02/01/2011	Source: Minnesota Pollution Control Agency
Date Data Arrived at EDR: 02/15/2011	Telephone: 651-649-5451
Date Made Active in Reports: 03/02/2011	Last EDR Contact: 03/23/2011
Number of Days to Update: 15	Next Scheduled EDR Contact: 05/30/2011
	Data Release Frequency: Varies

AST: Aboveground Storage Tanks
Registered Aboveground Storage Tanks.

Date of Government Version: 02/01/2011	Source: Minnesota Pollution Control Agency
Date Data Arrived at EDR: 02/15/2011	Telephone: 651-296-0930
Date Made Active in Reports: 03/02/2011	Last EDR Contact: 03/23/2011
Number of Days to Update: 15	Next Scheduled EDR Contact: 05/30/2011
	Data Release Frequency: Semi-Annually

INDIAN UST R5: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 02/11/2010	Source: EPA Region 5
Date Data Arrived at EDR: 02/11/2010	Telephone: 312-886-6136
Date Made Active in Reports: 04/12/2010	Last EDR Contact: 01/31/2011
Number of Days to Update: 60	Next Scheduled EDR Contact: 05/16/2011
	Data Release Frequency: Varies

INDIAN UST R1: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 09/01/2010	Source: EPA, Region 1
Date Data Arrived at EDR: 11/05/2010	Telephone: 617-918-1313
Date Made Active in Reports: 01/28/2011	Last EDR Contact: 02/03/2011
Number of Days to Update: 84	Next Scheduled EDR Contact: 05/16/2011
	Data Release Frequency: Varies

INDIAN UST R10: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 02/03/2011	Source: EPA Region 10
Date Data Arrived at EDR: 02/04/2011	Telephone: 206-553-2857
Date Made Active in Reports: 03/21/2011	Last EDR Contact: 01/31/2011
Number of Days to Update: 45	Next Scheduled EDR Contact: 05/16/2011
	Data Release Frequency: Quarterly

INDIAN UST R7: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 11/01/2010	Source: EPA Region 7
Date Data Arrived at EDR: 12/02/2010	Telephone: 913-551-7003
Date Made Active in Reports: 01/28/2011	Last EDR Contact: 02/03/2011
Number of Days to Update: 57	Next Scheduled EDR Contact: 05/16/2011
	Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

INDIAN UST R8: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 02/04/2011
Date Data Arrived at EDR: 02/04/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 45

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 01/31/2011
Next Scheduled EDR Contact: 05/16/2011
Data Release Frequency: Quarterly

INDIAN UST R9: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 01/31/2011
Date Data Arrived at EDR: 02/01/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 48

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 01/31/2011
Next Scheduled EDR Contact: 05/16/2011
Data Release Frequency: Quarterly

INDIAN UST R6: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 02/03/2011
Date Data Arrived at EDR: 02/04/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 45

Source: EPA Region 6
Telephone: 214-665-7591
Last EDR Contact: 01/31/2011
Next Scheduled EDR Contact: 05/16/2011
Data Release Frequency: Semi-Annually

INDIAN UST R4: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 08/27/2010
Date Data Arrived at EDR: 08/30/2010
Date Made Active in Reports: 10/04/2010
Number of Days to Update: 35

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 02/16/2011
Next Scheduled EDR Contact: 05/16/2011
Data Release Frequency: Semi-Annually

FEMA UST: Underground Storage Tank Listing
A listing of all FEMA owned underground storage tanks.

Date of Government Version: 01/01/2010
Date Data Arrived at EDR: 02/16/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 55

Source: FEMA
Telephone: 202-646-5797
Last EDR Contact: 01/17/2011
Next Scheduled EDR Contact: 05/02/2011
Data Release Frequency: Varies

State and tribal institutional control / engineering control registries

INST CONTROL: Site Remediation Section Database
Sites that have an Institutional Control event.

Date of Government Version: 01/03/2011
Date Data Arrived at EDR: 01/06/2011
Date Made Active in Reports: 02/02/2011
Number of Days to Update: 27

Source: Pollution Control Agency
Telephone: 512-296-6300
Last EDR Contact: 03/18/2011
Next Scheduled EDR Contact: 06/27/2011
Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

State and tribal voluntary cleanup sites

INDIAN VCP R1: Voluntary Cleanup Priority Listing
A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 09/01/2010	Source: EPA, Region 1
Date Data Arrived at EDR: 01/05/2011	Telephone: 617-918-1102
Date Made Active in Reports: 03/21/2011	Last EDR Contact: 01/05/2010
Number of Days to Update: 75	Next Scheduled EDR Contact: 04/18/2011
	Data Release Frequency: Varies

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng
A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008	Source: EPA, Region 7
Date Data Arrived at EDR: 04/22/2008	Telephone: 913-551-7365
Date Made Active in Reports: 05/19/2008	Last EDR Contact: 04/20/2009
Number of Days to Update: 27	Next Scheduled EDR Contact: 07/20/2009
	Data Release Frequency: Varies

VIC: Voluntary Investigation and Cleanup Program
Voluntary Investigation and Cleanup (VIC) Program List.

Date of Government Version: 01/03/2011	Source: Minnesota Pollution Control Agency
Date Data Arrived at EDR: 01/06/2011	Telephone: 651-296-7291
Date Made Active in Reports: 02/02/2011	Last EDR Contact: 03/18/2011
Number of Days to Update: 27	Next Scheduled EDR Contact: 06/27/2011
	Data Release Frequency: Quarterly

State and tribal Brownfields sites

BROWNFIELDS: Petroleum Brownfields Program Sites
Purchasing, selling, or developing property can present a special set of obstacles if the property is contaminated with chemicals. The Petroleum Brownfields Program is one of several programs within the Minnesota Pollution Control Agency (MPCA) designed to help people address these obstacles. The purpose of the Petroleum Brownfields Program is to provide the technical assistance and liability assurance needed to expedite and facilitate the development, transfer, investigation and/or cleanup of property that is contaminated with petroleum.

Date of Government Version: 09/30/2009	Source: Pollution Control Agency
Date Data Arrived at EDR: 03/17/2010	Telephone: 651-296-7999
Date Made Active in Reports: 03/31/2010	Last EDR Contact: 03/15/2011
Number of Days to Update: 14	Next Scheduled EDR Contact: 06/06/2011
	Data Release Frequency: Varies

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Included in the listing are brownfields properties addresses by Cooperative Agreement Recipients and brownfields properties addressed by Targeted Brownfields Assessments. Targeted Brownfields Assessments-EPA's Targeted Brownfields Assessments (TBA) program is designed to help states, tribes, and municipalities--especially those without EPA Brownfields Assessment Demonstration Pilots--minimize the uncertainties of contamination often associated with brownfields. Under the TBA program, EPA provides funding and/or technical assistance for environmental assessments at brownfields sites throughout the country. Targeted Brownfields Assessments supplement and work with other efforts under EPA's Brownfields Initiative to promote cleanup and redevelopment of brownfields. Cooperative Agreement Recipients-States, political subdivisions, territories, and Indian tribes become Brownfields Cleanup Revolving Loan Fund (BCRLF) cooperative agreement recipients when they enter into BCRLF cooperative agreements with the U.S. EPA. EPA selects BCRLF cooperative agreement recipients based on a proposal and application process. BCRLF cooperative agreement recipients must use EPA funds provided through BCRLF cooperative agreement for specified brownfields-related cleanup activities.

Date of Government Version: 12/29/2010
Date Data Arrived at EDR: 12/30/2010
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 81

Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 03/29/2011
Next Scheduled EDR Contact: 07/11/2011
Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

ODI: Open Dump Inventory
An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations
A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 137

Source: EPA, Region 9
Telephone: 415-947-4219
Last EDR Contact: 03/28/2011
Next Scheduled EDR Contact: 07/11/2011
Data Release Frequency: No Update Planned

SWRCY: Recycling Facilities
A listing of companies that accept commercial quantities of recyclable materials.

Date of Government Version: 10/07/2010
Date Data Arrived at EDR: 02/17/2011
Date Made Active in Reports: 02/24/2011
Number of Days to Update: 7

Source: Pollution Control Agency
Telephone: 651-296-6300
Last EDR Contact: 02/15/2011
Next Scheduled EDR Contact: 05/30/2011
Data Release Frequency: Varies

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands
Location of open dumps on Indian land.

Date of Government Version: 12/31/1998
Date Data Arrived at EDR: 12/03/2007
Date Made Active in Reports: 01/24/2008
Number of Days to Update: 52

Source: Environmental Protection Agency
Telephone: 703-308-8245
Last EDR Contact: 02/08/2011
Next Scheduled EDR Contact: 05/23/2011
Data Release Frequency: Varies

Local Lists of Hazardous waste / Contaminated Sites

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

US CDL: Clandestine Drug Labs
A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 12/03/2010
Date Data Arrived at EDR: 12/30/2010
Date Made Active in Reports: 02/16/2011
Number of Days to Update: 48

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 03/08/2011
Next Scheduled EDR Contact: 06/20/2011
Data Release Frequency: Quarterly

SRS: Site Remediation Section Database
The database contains site information for sites monitored by the Site Remediation Section.

Date of Government Version: 01/03/2011
Date Data Arrived at EDR: 01/06/2011
Date Made Active in Reports: 02/02/2011
Number of Days to Update: 27

Source: Pollution Control Agency
Telephone: 651-282-5988
Last EDR Contact: 01/06/2011
Next Scheduled EDR Contact: 12/27/2010
Data Release Frequency: Quarterly

MN DEL PLP: Delisted Permanent List of Priorities
This generally means that either no more cleanup at a site is needed or that no state superfund funding is needed for long term monitoring activities.

Date of Government Version: 06/30/2010
Date Data Arrived at EDR: 08/27/2010
Date Made Active in Reports: 10/19/2010
Number of Days to Update: 53

Source: Pollution Control Agency
Telephone: 651-296-6139
Last EDR Contact: 02/28/2011
Next Scheduled EDR Contact: 05/30/2011
Data Release Frequency: Annually

CDL: Clandestine Drug Labs
This data was passively gathered. That is, the DOH asks law enforcement and other agencies to notify them of Clandestine Drug Labs (CDLs). They do not require reporting of events. Therefore the data represents only a subset of all CDLs. This data has not been verified. The DOH has made no attempt to verify that reported CDLs actually occurred. They have no knowledge if the CDL was involved in cooking or just consisted of chemicals associated with Meth production. The reports they receive are that a suspected CDL was seized.

Date of Government Version: 01/11/2011
Date Data Arrived at EDR: 01/13/2011
Date Made Active in Reports: 02/02/2011
Number of Days to Update: 20

Source: Department of Health
Telephone: 651-215-5800
Last EDR Contact: 01/10/2011
Next Scheduled EDR Contact: 04/25/2011
Data Release Frequency: Varies

US HIST CDL: National Clandestine Laboratory Register
A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 09/01/2007
Date Data Arrived at EDR: 11/19/2008
Date Made Active in Reports: 03/30/2009
Number of Days to Update: 131

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 03/23/2009
Next Scheduled EDR Contact: 06/22/2009
Data Release Frequency: No Update Planned

Local Land Records

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

LIENS 2: CERCLA Lien Information

A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 11/09/2010
Date Data Arrived at EDR: 11/16/2010
Date Made Active in Reports: 02/16/2011
Number of Days to Update: 92

Source: Environmental Protection Agency
Telephone: 202-564-6023
Last EDR Contact: 01/31/2011
Next Scheduled EDR Contact: 05/16/2011
Data Release Frequency: Varies

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 12/09/2005
Date Data Arrived at EDR: 12/11/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 31

Source: Department of the Navy
Telephone: 843-820-7326
Last EDR Contact: 02/22/2011
Next Scheduled EDR Contact: 06/06/2011
Data Release Frequency: Varies

LIENS: Environmental Liens

Sites included in the Site Remediation System Database that have Environmental Liens.

Date of Government Version: 07/06/2006
Date Data Arrived at EDR: 07/07/2006
Date Made Active in Reports: 08/14/2006
Number of Days to Update: 38

Source: Pollution Control Agency
Telephone: 602-282-5988
Last EDR Contact: 03/18/2011
Next Scheduled EDR Contact: 06/27/2011
Data Release Frequency: Quarterly

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System

Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 12/31/2010
Date Data Arrived at EDR: 01/05/2011
Date Made Active in Reports: 02/25/2011
Number of Days to Update: 51

Source: U.S. Department of Transportation
Telephone: 202-366-4555
Last EDR Contact: 01/05/2011
Next Scheduled EDR Contact: 04/18/2011
Data Release Frequency: Annually

SPILLS: Spills Database

Spills reported to the Pollution Control Agency.

Date of Government Version: 11/01/2010
Date Data Arrived at EDR: 11/17/2010
Date Made Active in Reports: 11/30/2010
Number of Days to Update: 13

Source: Minnesota Pollution Control Agency
Telephone: 651-649-5451
Last EDR Contact: 03/23/2011
Next Scheduled EDR Contact: 05/30/2011
Data Release Frequency: Quarterly

AG SPILLS: Department of Agriculture Spills

This data is a list of pesticide/fertilizer incidents reported to have occurred in Minnesota.

Date of Government Version: 02/15/2011
Date Data Arrived at EDR: 02/16/2011
Date Made Active in Reports: 02/28/2011
Number of Days to Update: 12

Source: Department of Agriculture
Telephone: 651-297-3997
Last EDR Contact: 02/14/2011
Next Scheduled EDR Contact: 05/30/2011
Data Release Frequency: Semi-Annually

Other Ascertainable Records

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

RCRA-NonGen: RCRA - Non Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 02/17/2010
Date Data Arrived at EDR: 02/19/2010
Date Made Active in Reports: 05/17/2010
Number of Days to Update: 87

Source: Environmental Protection Agency
Telephone: 312-886-6186
Last EDR Contact: 01/06/2011
Next Scheduled EDR Contact: 04/18/2011
Data Release Frequency: Varies

DOT OPS: Incident and Accident Data

Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 10/13/2010
Date Data Arrived at EDR: 12/10/2010
Date Made Active in Reports: 02/25/2011
Number of Days to Update: 77

Source: Department of Transporation, Office of Pipeline Safety
Telephone: 202-366-4595
Last EDR Contact: 02/11/2011
Next Scheduled EDR Contact: 05/23/2011
Data Release Frequency: Varies

DOD: Department of Defense Sites

This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 11/10/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 62

Source: USGS
Telephone: 703-692-8801
Last EDR Contact: 01/21/2011
Next Scheduled EDR Contact: 05/02/2011
Data Release Frequency: Semi-Annually

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 08/12/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 112

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 03/15/2011
Next Scheduled EDR Contact: 06/27/2011
Data Release Frequency: Varies

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 10/01/2010
Date Data Arrived at EDR: 10/29/2010
Date Made Active in Reports: 01/28/2011
Number of Days to Update: 91

Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 01/03/2011
Next Scheduled EDR Contact: 04/18/2011
Data Release Frequency: Varies

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 02/25/2011
Date Data Arrived at EDR: 03/16/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 5

Source: EPA
Telephone: 703-416-0223
Last EDR Contact: 03/16/2011
Next Scheduled EDR Contact: 06/27/2011
Data Release Frequency: Annually

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 09/14/2010	Source: Department of Energy
Date Data Arrived at EDR: 10/21/2010	Telephone: 505-845-0011
Date Made Active in Reports: 01/28/2011	Last EDR Contact: 03/04/2011
Number of Days to Update: 99	Next Scheduled EDR Contact: 06/13/2011
	Data Release Frequency: Varies

MINES: Mines Master Index File

Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 08/04/2010	Source: Department of Labor, Mine Safety and Health Administration
Date Data Arrived at EDR: 09/09/2010	Telephone: 303-231-5959
Date Made Active in Reports: 12/02/2010	Last EDR Contact: 03/09/2011
Number of Days to Update: 84	Next Scheduled EDR Contact: 06/20/2011
	Data Release Frequency: Semi-Annually

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2009	Source: EPA
Date Data Arrived at EDR: 12/17/2010	Telephone: 202-566-0250
Date Made Active in Reports: 03/21/2011	Last EDR Contact: 03/01/2011
Number of Days to Update: 94	Next Scheduled EDR Contact: 06/13/2011
	Data Release Frequency: Annually

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2006	Source: EPA
Date Data Arrived at EDR: 09/29/2010	Telephone: 202-260-5521
Date Made Active in Reports: 12/02/2010	Last EDR Contact: 03/29/2011
Number of Days to Update: 64	Next Scheduled EDR Contact: 07/11/2011
	Data Release Frequency: Every 4 Years

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009	Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Date Data Arrived at EDR: 04/16/2009	Telephone: 202-566-1667
Date Made Active in Reports: 05/11/2009	Last EDR Contact: 02/28/2011
Number of Days to Update: 25	Next Scheduled EDR Contact: 06/13/2011
	Data Release Frequency: Quarterly

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009	Source: EPA
Date Data Arrived at EDR: 04/16/2009	Telephone: 202-566-1667
Date Made Active in Reports: 05/11/2009	Last EDR Contact: 02/28/2011
Number of Days to Update: 25	Next Scheduled EDR Contact: 06/13/2011
	Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing

A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing

A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

SSTS: Section 7 Tracking Systems

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 12/10/2010
Date Made Active in Reports: 02/25/2011
Number of Days to Update: 77

Source: EPA
Telephone: 202-564-4203
Last EDR Contact: 01/31/2011
Next Scheduled EDR Contact: 05/16/2011
Data Release Frequency: Annually

ICIS: Integrated Compliance Information System

The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 01/07/2011
Date Data Arrived at EDR: 01/21/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 59

Source: Environmental Protection Agency
Telephone: 202-564-5088
Last EDR Contact: 03/28/2011
Next Scheduled EDR Contact: 07/11/2011
Data Release Frequency: Quarterly

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 11/01/2010
Date Data Arrived at EDR: 11/10/2010
Date Made Active in Reports: 02/16/2011
Number of Days to Update: 98

Source: EPA
Telephone: 202-566-0500
Last EDR Contact: 01/21/2011
Next Scheduled EDR Contact: 05/02/2011
Data Release Frequency: Annually

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

MLTS: Material Licensing Tracking System

MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 03/18/2010	Source: Nuclear Regulatory Commission
Date Data Arrived at EDR: 04/06/2010	Telephone: 301-415-7169
Date Made Active in Reports: 05/27/2010	Last EDR Contact: 03/14/2011
Number of Days to Update: 51	Next Scheduled EDR Contact: 06/27/2011
	Data Release Frequency: Quarterly

RADINFO: Radiation Information Database

The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 01/11/2011	Source: Environmental Protection Agency
Date Data Arrived at EDR: 01/13/2011	Telephone: 202-343-9775
Date Made Active in Reports: 02/16/2011	Last EDR Contact: 01/13/2011
Number of Days to Update: 34	Next Scheduled EDR Contact: 04/25/2011
	Data Release Frequency: Quarterly

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 04/14/2010	Source: EPA
Date Data Arrived at EDR: 04/16/2010	Telephone: (312) 353-2000
Date Made Active in Reports: 05/27/2010	Last EDR Contact: 03/14/2011
Number of Days to Update: 41	Next Scheduled EDR Contact: 06/27/2011
	Data Release Frequency: Quarterly

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995	Source: EPA
Date Data Arrived at EDR: 07/03/1995	Telephone: 202-564-4104
Date Made Active in Reports: 08/07/1995	Last EDR Contact: 06/02/2008
Number of Days to Update: 35	Next Scheduled EDR Contact: 09/01/2008
	Data Release Frequency: No Update Planned

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2007	Source: EPA/NTIS
Date Data Arrived at EDR: 02/25/2010	Telephone: 800-424-9346
Date Made Active in Reports: 05/12/2010	Last EDR Contact: 03/01/2011
Number of Days to Update: 76	Next Scheduled EDR Contact: 06/13/2011
	Data Release Frequency: Biennially

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

LS: List of Sites

The List of Sites includes: Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS), No Further Remedial Action Planned (NFRAP), National Priorities List (NPL), Permanent List of Priorities (PLP), sites delisted from the Permanent List of Priorities (DPLP), Hazardous Waste Permit Unit Project Facilities (HW PERM), List of Permitted Solid Waste Facilities (SW PERM), 1980 Metropolitan Area Waste Disposal Site Inventory (METRO), 1980 Statewide Outstate Dump Inventory (ODI), Voluntary and Investigation Program (VIC), and Closed Landfill Sites Undergoing Cleanup (LCP).

Date of Government Version: 04/22/2009
Date Data Arrived at EDR: 07/14/2009
Date Made Active in Reports: 07/24/2009
Number of Days to Update: 10

Source: Minnesota Pollution Control Agency
Telephone: 651-297-2731
Source: Pollution Control Agency, GIS Section
Telephone: 651-297-2731
Last EDR Contact: 03/28/2011
Next Scheduled EDR Contact: 07/11/2011
Data Release Frequency: Semi-Annually

BULK: Bulk Facilities Database

Facilities that use bulk pesticides and fertilizers

Date of Government Version: 09/14/2010
Date Data Arrived at EDR: 09/16/2010
Date Made Active in Reports: 10/19/2010
Number of Days to Update: 33

Source: Department of Agriculture
Telephone: 651-297-3997
Last EDR Contact: 03/01/2011
Next Scheduled EDR Contact: 05/30/2011
Data Release Frequency: Semi-Annually

MANIFEST: Hazardous Waste Manifest Data

Hazardous waste manifest data.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 07/22/2010
Date Made Active in Reports: 08/17/2010
Number of Days to Update: 26

Source: Pollution Control Agency
Telephone: 651-296-7258
Last EDR Contact: 03/21/2011
Next Scheduled EDR Contact: 07/04/2011
Data Release Frequency: Annually

DRYCLEANERS: Registered Drycleaning Facilities

A listing of coin-operated laundries and drycleaning; drycleaning plants, except rug cleaning; and industrial launderers.

Date of Government Version: 12/21/2010
Date Data Arrived at EDR: 12/23/2010
Date Made Active in Reports: 02/02/2011
Number of Days to Update: 41

Source: Pollution Control Agency
Telephone: 651-296-6300
Last EDR Contact: 03/21/2011
Next Scheduled EDR Contact: 07/04/2011
Data Release Frequency: Varies

ENFORCEMENT: Generators Associated with Enforcement Logs

Regulatory Compliance, Hazardous Waste Enforcement Log and Hazardous Waste Permit Unit Project Identification List.

Date of Government Version: 12/20/2010
Date Data Arrived at EDR: 01/14/2011
Date Made Active in Reports: 02/02/2011
Number of Days to Update: 19

Source: Minnesota Pollution Control Agency
Telephone: 651-297-8332
Last EDR Contact: 03/21/2011
Next Scheduled EDR Contact: 07/04/2011
Data Release Frequency: Quarterly

MN HWS PERMIT: Active TSD Facilities

Active TSD Facilities.

Date of Government Version: 09/21/2010
Date Data Arrived at EDR: 09/24/2010
Date Made Active in Reports: 10/19/2010
Number of Days to Update: 25

Source: Minnesota Pollution Control Agency
Telephone: 651-297-8470
Last EDR Contact: 03/21/2011
Next Scheduled EDR Contact: 07/04/2011
Data Release Frequency: Annually

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

AIRS: Permit Contact List
A listing of permitted AIRS facilities.

Date of Government Version: 12/01/2010
Date Data Arrived at EDR: 12/02/2010
Date Made Active in Reports: 12/23/2010
Number of Days to Update: 21

Source: Pollution Control Agency
Telephone: 651-296-7351
Last EDR Contact: 02/28/2011
Next Scheduled EDR Contact: 05/30/2011
Data Release Frequency: Varies

TIER 2: Tier 2 Facility Listing
A listing of facilities which store or manufacture hazardous materials that submit a chemical inventory report.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 11/16/2010
Date Made Active in Reports: 11/30/2010
Number of Days to Update: 14

Source: Department of Public Safety
Telephone: 651-296-2233
Last EDR Contact: 02/14/2011
Next Scheduled EDR Contact: 05/30/2011
Data Release Frequency: Varies

INDIAN RESERV: Indian Reservations
This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 12/08/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 34

Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 01/21/2011
Next Scheduled EDR Contact: 05/02/2011
Data Release Frequency: Semi-Annually

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing
The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 08/31/2010
Date Data Arrived at EDR: 09/01/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 92

Source: Environmental Protection Agency
Telephone: 615-532-8599
Last EDR Contact: 02/22/2011
Next Scheduled EDR Contact: 05/09/2011
Data Release Frequency: Varies

WIMN: What's In My Neighborhood
Since 2003, the PCAa??s "Whata??s in My Neighborhood?" database provides information about air quality, hazardous waste, remediation, solid waste, tanks and leaks, and water quality around Minnesota.

Date of Government Version: 01/17/2011
Date Data Arrived at EDR: 01/18/2011
Date Made Active in Reports: 02/24/2011
Number of Days to Update: 37

Source: Pollution Control Agency
Telephone: 651-757-2593
Last EDR Contact: 01/18/2011
Next Scheduled EDR Contact: 05/02/2011
Data Release Frequency: Varies

COAL ASH DOE: Sleam-Electric Plan Operation Data
A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 08/07/2009
Date Made Active in Reports: 10/22/2009
Number of Days to Update: 76

Source: Department of Energy
Telephone: 202-586-8719
Last EDR Contact: 01/18/2011
Next Scheduled EDR Contact: 05/02/2011
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

MDA LIS: Licensing Information System Database Listing
Information provided lists all individuals or companies who hold licenses, certificates and/or permits required by state law and regulated by the Department. Additionally, the LIS lists all companies who must register products with the Department before being used or sold in commercial channels within our state.

Date of Government Version: 09/14/2010	Source: Department of Agriculture
Date Data Arrived at EDR: 09/16/2010	Telephone: 651-201-6000
Date Made Active in Reports: 10/19/2010	Last EDR Contact: 03/01/2011
Number of Days to Update: 33	Next Scheduled EDR Contact: 05/30/2011
	Data Release Frequency: Varies

COAL ASH: Coal Ash Disposal Site Listing
A listing of coal ash disposal site locations.

Date of Government Version: 11/16/2010	Source: Pollution Control Agency
Date Data Arrived at EDR: 11/19/2010	Telephone: 651-757-2740
Date Made Active in Reports: 11/30/2010	Last EDR Contact: 02/28/2011
Number of Days to Update: 11	Next Scheduled EDR Contact: 05/30/2011
	Data Release Frequency: Varies

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List
A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 08/17/2010	Source: Environmental Protection Agency
Date Data Arrived at EDR: 01/03/2011	Telephone: N/A
Date Made Active in Reports: 03/21/2011	Last EDR Contact: 03/18/2011
Number of Days to Update: 77	Next Scheduled EDR Contact: 06/27/2011
	Data Release Frequency: Varies

FEDLAND: Federal and Indian Lands
Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 12/31/2005	Source: U.S. Geological Survey
Date Data Arrived at EDR: 02/06/2006	Telephone: 888-275-8747
Date Made Active in Reports: 01/11/2007	Last EDR Contact: 01/21/2011
Number of Days to Update: 339	Next Scheduled EDR Contact: 05/02/2011
	Data Release Frequency: N/A

AGVIC: Agricultural Voluntary Investigation & Cleanup Listing
A listing of agricultural voluntary investigation & cleanup site locations.

Date of Government Version: 02/15/2011	Source: Department of Agriculture
Date Data Arrived at EDR: 02/16/2011	Telephone: 651-201-6400
Date Made Active in Reports: 02/28/2011	Last EDR Contact: 02/14/2011
Number of Days to Update: 12	Next Scheduled EDR Contact: 05/30/2011
	Data Release Frequency: Quarterly

PCB TRANSFORMER: PCB Transformer Registration Database
The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 01/01/2008	Source: Environmental Protection Agency
Date Data Arrived at EDR: 02/18/2009	Telephone: 202-566-0517
Date Made Active in Reports: 05/29/2009	Last EDR Contact: 02/04/2011
Number of Days to Update: 100	Next Scheduled EDR Contact: 05/16/2011
	Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

EDR PROPRIETARY RECORDS

EDR Proprietary Records

Manufactured Gas Plants: EDR Proprietary Manufactured Gas Plants

The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

CT MANIFEST: Hazardous Waste Manifest Data

Facility and manifest data. Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a tsd facility.

Date of Government Version: 12/31/2007
Date Data Arrived at EDR: 08/26/2009
Date Made Active in Reports: 09/11/2009
Number of Days to Update: 16

Source: Department of Environmental Protection
Telephone: 860-424-3375
Last EDR Contact: 02/25/2011
Next Scheduled EDR Contact: 06/06/2011
Data Release Frequency: Annually

NJ MANIFEST: Manifest Information

Hazardous waste manifest information.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 07/22/2010
Date Made Active in Reports: 08/26/2010
Number of Days to Update: 35

Source: Department of Environmental Protection
Telephone: N/A
Last EDR Contact: 01/21/2011
Next Scheduled EDR Contact: 05/02/2011
Data Release Frequency: Annually

NY MANIFEST: Facility and Manifest Data

Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

Date of Government Version: 12/31/2010
Date Data Arrived at EDR: 02/09/2011
Date Made Active in Reports: 03/04/2011
Number of Days to Update: 23

Source: Department of Environmental Conservation
Telephone: 518-402-8651
Last EDR Contact: 02/09/2011
Next Scheduled EDR Contact: 05/23/2011
Data Release Frequency: Annually

PA MANIFEST: Manifest Information

Hazardous waste manifest information.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 12/31/2008
Date Data Arrived at EDR: 12/01/2009
Date Made Active in Reports: 12/14/2009
Number of Days to Update: 13

Source: Department of Environmental Protection
Telephone: 717-783-8990
Last EDR Contact: 02/18/2011
Next Scheduled EDR Contact: 06/06/2011
Data Release Frequency: Annually

RI MANIFEST: Manifest information
Hazardous waste manifest information

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 07/19/2010
Date Made Active in Reports: 08/26/2010
Number of Days to Update: 38

Source: Department of Environmental Management
Telephone: 401-222-2797
Last EDR Contact: 02/28/2011
Next Scheduled EDR Contact: 06/13/2011
Data Release Frequency: Annually

WI MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 07/06/2010
Date Made Active in Reports: 07/26/2010
Number of Days to Update: 20

Source: Department of Natural Resources
Telephone: N/A
Last EDR Contact: 03/21/2011
Next Scheduled EDR Contact: 07/04/2011
Data Release Frequency: Annually

Oil/Gas Pipelines: This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines.

Electric Power Transmission Line Data
Source: Rextag Strategies Corp.
Telephone: (281) 769-2247
U.S. Electric Transmission and Power Plants Systems Digital GIS Data

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Daycare Centers: Child Care Centers
Source: Department of Human Services
Telephone: 651-296-3971

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2009 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 and 2005 from the U.S. Fish and Wildlife Service.

STREET AND ADDRESS INFORMATION

GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

MARSH LAKE
LOUISBURG ROAD
APPLETON, MN 56208

TARGET PROPERTY COORDINATES

Latitude (North):	45.17390 - 45˚ 10' 26.0"
Longitude (West):	96.0897 - 96˚ 5' 22.9"
Universal Tranverse Mercator:	Zone 14
UTM X (Meters):	728687.6
UTM Y (Meters):	5006172.5
Elevation:	939 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	45096-B1 APPLETON, MN
Most Recent Revision:	1977

EDR's GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principle investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

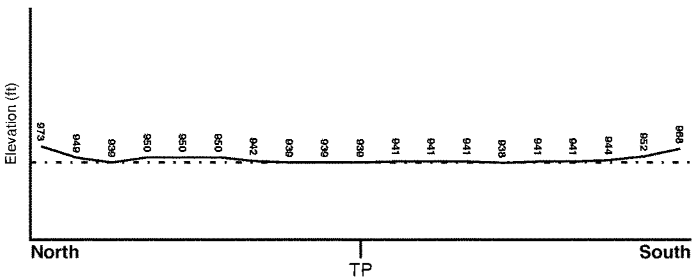
TOPOGRAPHIC INFORMATION

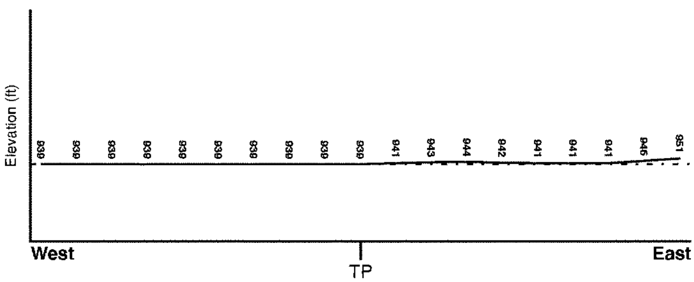
Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

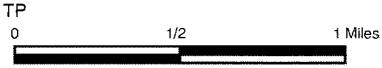
General Topographic Gradient: General West

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES





Target Property Elevation: 939 ft.



Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Target Property County	FEMA Flood Electronic Data
SWIFT, MN	YES - refer to the Overview Map and Detail Map

Flood Plain Panel at Target Property:	27151C - FEMA DFIRM Flood data
Additional Panels in search area:	27011C - FEMA DFIRM Flood data 27073C - FEMA DFIRM Flood data

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
APPLETON	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Site-Specific Hydrogeological Data*:

Search Radius:	1.25 miles
Status:	Not found

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT		GEOLOGIC AGE IDENTIFICATION	
Era:	Precambrian	Category:	Metamorphic Rocks
System:	Precambrian		
Series:	Orthogneiss and paragneiss		
Code:	Wgn *(decoded above as Era, System & Series)*		

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

SSURGO SOIL MAP - 3028253.2s

SITE NAME: Marsh Lake ADDRESS: Louisburg Road Appleton MN 56208 LAT/LONG: 45.1739 / 96.0897	CLIENT: Army Corp of Engineers CONTACT: Ellen Engberg INQUIRY #: 3028253.2s DATE: March 31, 2011 1:50 pm

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. The following information is based on Soil Conservation Service SSURGO data.

Soil Map ID: 1

Soil Component Name: Rauville

Soil Surface Texture: silty clay loam

Hydrologic Group: Class D - Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer.

Soil Drainage Class: Very poorly drained

Hydric Status: All hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
1	0 inches	27 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14.11 Min: 1.4	Max: 8.4 Min: 7.4
2	44 inches	59 inches	stratified sand to clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14.11 Min: 1.4	Max: 8.4 Min: 7.4
3	27 inches	44 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14.11 Min: 1.4	Max: 8.4 Min: 7.4

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Map ID: 2

Soil Component Name:	Water
Soil Surface Texture:	silty clay loam
Hydrologic Group:	Class D - Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer.

Soil Drainage Class:
Hydric Status: Unknown

Corrosion Potential - Uncoated Steel:	Not Reported
Depth to Bedrock Min:	> 0 inches
Depth to Watertable Min:	> 0 inches

No Layer Information available.

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No Wells Found		

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No PWS System Found		

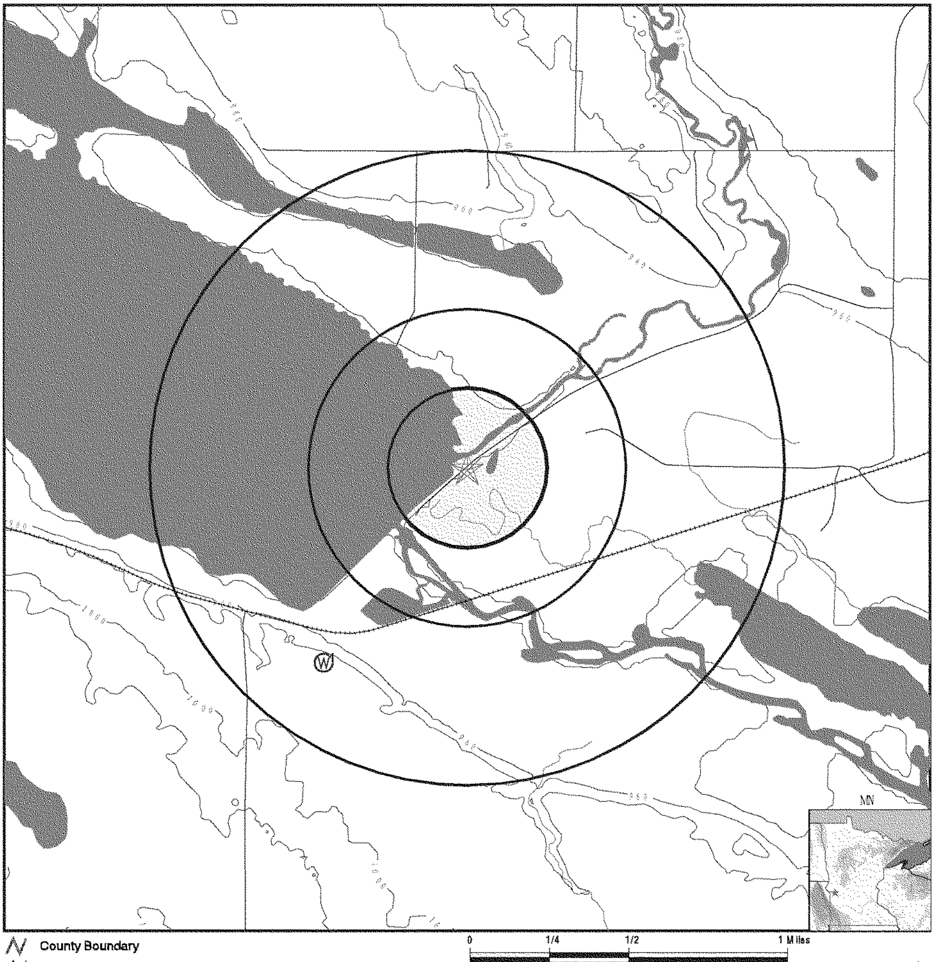
Note: PWS System location is not always the same as well location.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
1	MN3000000085404	1/2 - 1 Mile SW

PHYSICAL SETTING SOURCE MAP - 3028253.2s



County Boundary
Major Roads
Contour Lines
Earthquake epicenter, Richter 5 or greater
Water Wells
Public Water Supply Wells
Cluster of Multiple Icons

Groundwater Flow Direction
Indeterminate Groundwater Flow at Location
Groundwater Flow Varies at Location
Closest Hydrogeological Data

SITE NAME: Marsh Lake ADDRESS: Louisburg Road Appleton MN 56208 LAT/LONG: 45.1739 / 96.0897	CLIENT: Army Corp of Engineers CONTACT: Ellen Engberg INQUIRY #: 3028253.2s DATE: March 31, 2011 1:50 pm

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID Direction Distance Elevation	Database	EDR ID Number
1 **SW** **1/2 - 1 Mile** **Higher**	**MN WELLS**	**MN3000000085404**

Relateid:	0000213844	County c:	Lacq.parle
Unique no:	00213844	Wellname:	MOEN, ROGER
Township:	120	Range:	43
Range dir:	W	Section:	31
Subsection:	BBADDD	Mgsquad c:	Appleton
Elevation:	987		
Elev mc:	7.5 minute topographic map (+/- 5 feet)		
Status c:	Active		
Use c:	Domestic	Loc mc:	Information from owner
Loc src:	Minnesota Geological Survey	Data src:	USGS
Depth drll:	166		
Depth comp:	166		
Date drll:	19610000		
Case diam:	4		
Case depth:	160		
Grout:	Not Reported	Pollut dst:	0
Pollut dir:	Not Reported	Pollut typ:	Not Reported
Strat date:	19970213		
Strat upd:	19970213		
Strat src:	Minnesota Geological Survey	Strat geol:	Dale Setterholm
Strat mc:	Geologic study 1:24k to 1:100k		
Depth2bdrk:	0		
First bdrk:	Not Reported	Last strat:	Sand
Ohtopunit:	QFUU	Ohbotunit:	QFUU
Aquifer:	QBAA	Cuttings:	Not Reported
Core:	Not Reported	Bhgeophys:	Not Reported
Geochem:	Not Reported	Waterchem:	Not Reported
Obwell:	Not Reported	Swl:	Not Reported
Igwis:	Not Reported	Input src:	Minnesota Geological Survey
Unused:	Not Reported		
Entry date:	19880411		
Updt date:	19970213		
Geoc type:	WW	Gcm code:	A
Geoc src:	MGS	Geoc prg:	CWI
Utme:	256458		
Utmn:	5005954		
Geoc entry:	0		
Geoc date:	19960410		
Geocupd en:	0		
Geocupd da:	0		
Rcvd date:	0		
Well label:	213844	Swlcount:	0
Swldate:	0		
Swlavgmeas:	0		
Swlavgelev:	0		
Site id:	MN3000000085404		

GEOCHECK®- PHYSICAL SETTING SOURCE MAP FINDINGS

Address Information:

Relateid:	0000213844	Name:	MOEN, ROGER
Addtype c:	Both	House no:	Not Reported
Street:	Not Reported	Road type:	Not Reported
Road dir:	Not Reported	City:	LOUISBURG
State:	MN	Zipcode:	56254
Entry date:	19880411		
Updt date:	19970213		
Other:	Not Reported		

Construction 1 Information:

Relateid:	0000213844	Drill meth:	Cable Tool
Drill flud:	Not Reported	Hydrofrac:	Not Reported
Hffrom:	Not Reported		
Hfto:	Not Reported		
Case mat:	Steel (black or low carbon)	Case joint:	Not Reported
Case top:	0		
Drive shoe:	Not Reported	Case type:	Single casing
Screen:	N		
Ohtopfeet:	160		
Ohbotfeet:	160		
Screen mfg:	Not Reported	Screen typ:	Not Reported
Ptlss mfg:	Not Reported	Ptlss mdl:	Not Reported
Bsmt offst:	Not Reported	Csg top ok:	Not Reported
Csg at grd:	Not Reported	Plstc prot:	Not Reported
Disinfectd:	Not Reported	Pump inst:	Not Reported
Pump date:	Not Reported		
Pump mfg:	Not Reported	Pump model:	Not Reported
Pump hp:	0		
Pump volts:	Not Reported		
Dropp len:	Not Reported		
Dropp mat:	Not Reported		
Pump cpcty:	Not Reported		
Pump type:	Not Reported	Variance:	Not Reported
Drllr name:	Not Reported		
Entry date:	19880411		
Updt date:	19970213		

Construction 2 Information:

Relateid:	0000213844	Constype:	C
From depth:	0		
To depth:	160		
Diameter:	4		
Slot:	Not Reported		
Length:	Not Reported		
Material:	Not Reported		
Amount:	Not Reported		
Units:	Not Reported		

Remarks Information:

Relateid:	0000213844
Seq no:	1
Remarks:	NURE SAMPLE NO. 601321.

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

State Database: MN Radon

Radon Test Results

Zipcode	Num Tests	Minimum	Maximum	Average	# > 4 pCi/L	# < 4 pCi/L
56208	98	0.0	22.6	5.4	56	42

Federal EPA Radon Zone for SWIFT County: 1

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for SWIFT COUNTY, MN

Number of sites tested: 4

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	Not Reported	Not Reported	Not Reported	Not Reported
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	2.925 pCi/L	75%	25%	0%

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5' Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

HYDROLOGIC INFORMATION

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2009 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 and 2005 from the U.S. Fish and Wildlife Service.

HYDROGEOLOGIC INFORMATION

AQUIFLOW[R] Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services
The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Services, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

Minnesota Groundwater Database
Source: Minnesota Geological Survey County Water Well Index (CWI)
Telephone: 612-627-4780

OTHER STATE DATABASE INFORMATION

RADON

State Database: MN Radon
Source: Department of Health
Telephone: 651-215-0909
Radon Test Results

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

STREET AND ADDRESS INFORMATION

Marsh Lake Dam
Marsh Lake
Madison, MN 56256

Inquiry Number: 2627945.2s
October 30, 2009

The EDR Radius Map™ Report with GeoCheck®

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
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FORM-PST-TIB

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GEOCHECK ADDENDUM

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-05) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

MARSH LAKE
MADISON, MN 56256

COORDINATES

Latitude (North):	45.188200 - 45˚ 11' 17.5"
Longitude (West):	96.132800 - 96˚ 7' 58.1"
Universal Tranverse Mercator:	Zone 14
UTM X (Meters):	725244.4
UTM Y (Meters):	5007640.0
Elevation:	941 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	45096-B2 CORRELL, MN
Most Recent Revision:	1958
East Map:	45096-B1 APPLETON, MN
Most Recent Revision:	1977

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL........................ National Priority List
Proposed NPL............... Proposed National Priority List Sites
NPL LIENS.................. Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL............... National Priority List Deletions

EXECUTIVE SUMMARY

Federal CERCLIS list

CERCLIS........................ Comprehensive Environmental Response, Compensation, and Liability Information System

Federal CERCLIS NFRAP site List

CERC-NFRAP.................... CERCLIS No Further Remedial Action Planned

Federal RCRA CORRACTS facilities list

CORRACTS...................... Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF..................... RCRA - Transporters, Storage and Disposal

Federal RCRA generators list

RCRA-LQG...................... RCRA - Large Quantity Generators
RCRA-SQG...................... RCRA - Small Quantity Generators
RCRA-CESQG.................... RCRA - Conditionally Exempt Small Quantity Generator

Federal institutional controls / engineering controls registries

US ENG CONTROLS........... Engineering Controls Sites List
US INST CONTROL............ Sites with Institutional Controls

Federal ERNS list

ERNS.............................. Emergency Response Notification System

State- and tribal - equivalent NPL

MN PLP........................... Permanent List of Priorities

State- and tribal - equivalent CERCLIS

SHWS............................. Superfund Site Information Listing

State and tribal landfill and/or solid waste disposal site lists

SWF/LF........................... Permitted Solid Waste Disposal Facilities
LCP................................ Closed Landfills Priority List

State and tribal leaking storage tank lists

LUST............................... Leak Sites
LAST............................... Leaking Aboveground Storage Tanks
INDIAN LUST.................... Leaking Underground Storage Tanks on Indian Land

State and tribal registered storage tank lists

UST................................. Underground Storage Tank Database
AST................................. Aboveground Storage Tanks

EXECUTIVE SUMMARY

INDIAN UST................. Underground Storage Tanks on Indian Land

State and tribal institutional control / engineering control registries

INST CONTROL............. Site Remediation Section Database

State and tribal voluntary cleanup sites

VIC.......................... Voluntary Investigation and Cleanup Program
INDIAN VCP................. Voluntary Cleanup Priority Listing

State and tribal Brownfields sites

BROWNFIELDS............. Petroleum Brownfields Program Sites

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS.......... A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

DEBRIS REGION 9.......... Torres Martinez Reservation Illegal Dump Site Locations
ODI.......................... Open Dump Inventory
INDIAN ODI................. Report on the Status of Open Dumps on Indian Lands

Local Lists of Hazardous waste / Contaminated Sites

US CDL...................... Clandestine Drug Labs
SRS.......................... Site Remediation Section Database
MN DEL PLP................ Delisted Permanent List of Priorities
CDL.......................... Clandestine Drug Labs
US HIST CDL............... National Clandestine Laboratory Register

Local Land Records

LIENS 2..................... CERCLA Lien Information
LUCIS....................... Land Use Control Information System
LIENS....................... Environmental Liens

Records of Emergency Release Reports

HMIRS...................... Hazardous Materials Information Reporting System
SPILLS...................... Spills Database
AGSPILLS.................. Department of Agriculture Spills

Other Ascertainable Records

RCRA-NonGen............. RCRA - Non Generators
DOT OPS.................. Incident and Accident Data
FUDS....................... Formerly Used Defense Sites
CONSENT................... Superfund (CERCLA) Consent Decrees
ROD......................... Records Of Decision

EXECUTIVE SUMMARY

UMTRA	Uranium Mill Tailings Sites
MINES	Mines Master Index File
TRIS	Toxic Chemical Release Inventory System
TSCA	Toxic Substances Control Act
FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing
SSTS	Section 7 Tracking Systems
ICIS	Integrated Compliance Information System
PADS	PCB Activity Database System
MLTS	Material Licensing Tracking System
RADINFO	Radiation Information Database
FINDS	Facility Index System/Facility Registry System
RAATS	RCRA Administrative Action Tracking System
MN LS	List of Sites
BULK	Bulk Facilities Database
DRYCLEANERS	Registered Drycleaning Facilities
ENF	Generators Associated with Enforcement Logs
MN HWS Permit	Active TSD Facilities
AIRS	Permit Contact List
TIER 2	Tier 2 Facility Listing
INDIAN RESERV	Indian Reservations
SCRD DRYCLEANERS	State Coalition for Remediation of Drycleaners Listing
PCB TRANSFORMER	PCB Transformer Registration Database
COAL ASH	Coal Ash Disposal Site Listing
MDA LIS	Licensing Information System Database Listing

EDR PROPRIETARY RECORDS

EDR Proprietary Records

Manufactured Gas Plants	EDR Proprietary Manufactured Gas Plants

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

ADDITIONAL ENVIRONMENTAL RECORDS

Other Ascertainable Records

EXECUTIVE SUMMARY

DOD: Consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

A review of the DOD list, as provided by EDR, and dated 12/31/2005 has revealed that there is 1 DOD site within approximately 1.5 miles of the target property.

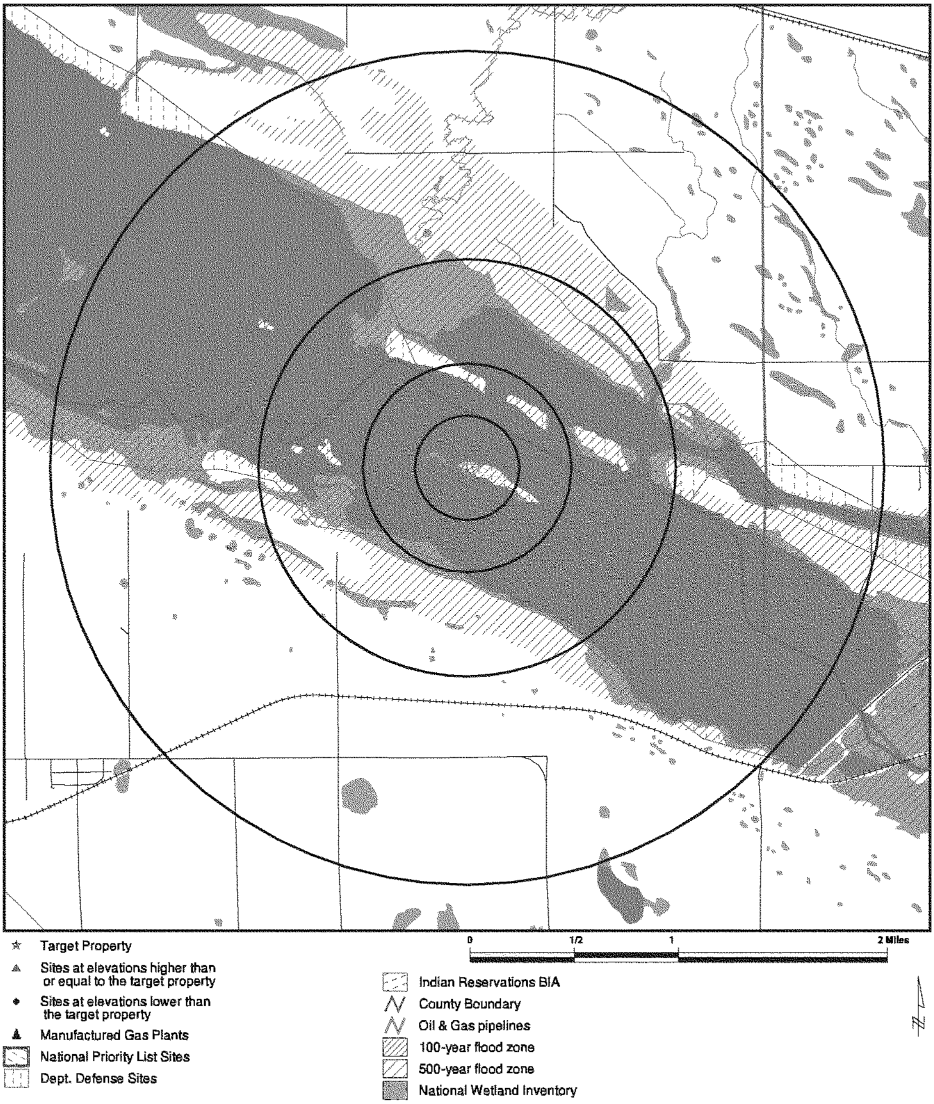
Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
MASH LAKE		0 - 1/8 (0.000 mi.)	0	7

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped:

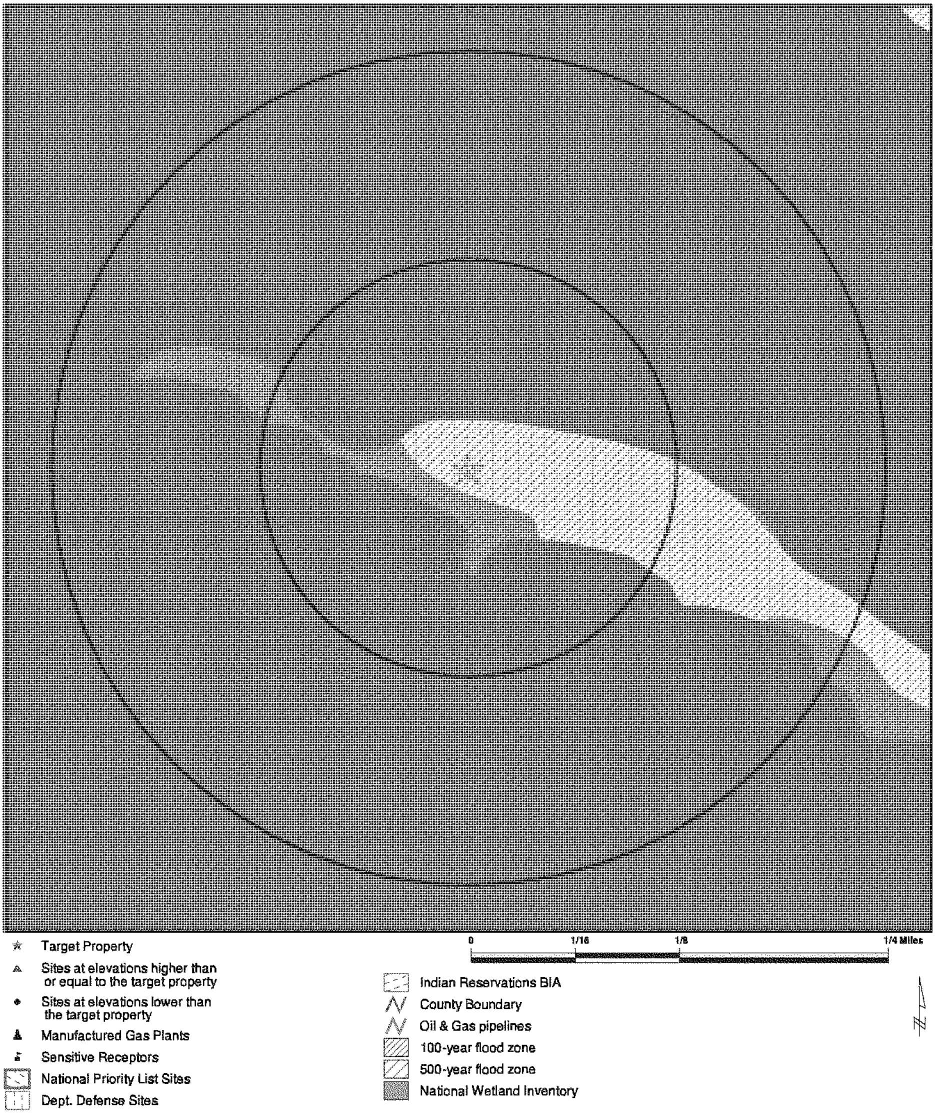
Site Name	Database(s)
MUNICIPAL CASTINGS	FTTS, HIST FTTS
MADISON COMPOST SITE PBR	SWF/LF
LAC QUI PARLE COUNTY DEMOLITION LA	FINDS, SWF/LF
MADISON INCINERATOR ASH LANDFILL	SWF/LF
GERHARD WITTNEBEL GRAVEL PIT	SWF/LF
BELLINGHAM FARMERS CO-OP ELEVATOR	LUST, LAST
CENEX (FORMER LAC QUI PARLE COOP)	LUST
GAS AND GRUB	LUST
MADISON AIRPORT	LUST
MN DEPT OF TRANSPORTATION TRUCK ST	LUST
WESTPHAL TRUCKING	LUST
MNDOT TRUCK STATION	UST, AST
MADISON GAS & GRUB	UST
MUNICIPAL CASTINGS INC	UST, AST
SCHMIEG OIL CO	AST
LUND IMPLEMENT CO	FINDS, RCRA-NonGen
MINN KOTA TRANSFER INC	FINDS, RCRA-CESQG
MADISON WELDING & REPAIR	FINDS, RCRA-CESQG
THOMPSON CHUCK DBA FARM ADVANTAGE	BULK
FIELDCREST FERT	ICIS
HALVORSON MYRON	ICIS
FIELDCREST FERTILIZER	SSTS
FIELDCREST FERT CO	SSTS
MNDOT	TIER 2
LAC QUI PARLE COOP OIL	TIER 2

OVERVIEW MAP - 2627945.2s



SITE NAME:	Marsh Lake Dam	CLIENT:	Army Corp of Engineers
ADDRESS:	Marsh Lake Madison MN 56256	CONTACT:	Grant Riddick
		INQUIRY #:	2627945.2s
LAT/LONG:	45.1882 / 96.1328	DATE:	October 30, 2009 5:19 pm

DETAIL MAP - 2627945.2s



SITE NAME:	Marsh Lake Dam	CLIENT:	Army Corp of Engineers
ADDRESS:	Marsh Lake	CONTACT:	Grant Riddick
	Madison MN 56256	INQUIRY #:	2627945.2s
LAT/LONG:	45.1882 / 96.1328	DATE:	October 30, 2009 5:19 pm

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL		1.500	0	0	0	0	0	0
Proposed NPL		1.500	0	0	0	0	0	0
NPL LIENS		0.500	0	0	0	NR	NR	0
Federal Delisted NPL site list								
Delisted NPL		1.500	0	0	0	0	0	0
Federal CERCLIS list								
CERCLIS		1.000	0	0	0	0	NR	0
Federal CERCLIS NFRAP site List								
CERC-NFRAP		1.000	0	0	0	0	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS		1.500	0	0	0	0	0	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF		1.000	0	0	0	0	NR	0
Federal RCRA generators list								
RCRA-LQG		0.750	0	0	0	0	NR	0
RCRA-SQG		0.750	0	0	0	0	NR	0
RCRA-CESQG		0.750	0	0	0	0	NR	0
Federal institutional controls / engineering controls registries								
US ENG CONTROLS		1.000	0	0	0	0	NR	0
US INST CONTROL		1.000	0	0	0	0	NR	0
Federal ERNS list								
ERNS		0.500	0	0	0	NR	NR	0
State- and tribal - equivalent NPL								
MN PLP		1.000	0	0	0	0	NR	0
State- and tribal - equivalent CERCLIS								
SHWS		1.500	0	0	0	0	0	0
State and tribal landfill and/or solid waste disposal site lists								
SWF/LF		1.000	0	0	0	0	NR	0
LCP		1.000	0	0	0	0	NR	0
State and tribal leaking storage tank lists								
LUST		1.000	0	0	0	0	NR	0
LAST		1.000	0	0	0	0	NR	0

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
INDIAN LUST		1.000	0	0	0	0	NR	0
State and tribal registered storage tank lists								
UST		0.750	0	0	0	0	NR	0
AST		0.750	0	0	0	0	NR	0
INDIAN UST		0.750	0	0	0	0	NR	0
State and tribal institutional control / engineering control registries								
INST CONTROL		1.000	0	0	0	0	NR	0
State and tribal voluntary cleanup sites								
VIC		1.000	0	0	0	0	NR	0
INDIAN VCP		1.000	0	0	0	0	NR	0
State and tribal Brownfields sites								
BROWNFIELDS		1.000	0	0	0	0	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS		1.000	0	0	0	0	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
DEBRIS REGION 9		1.000	0	0	0	0	NR	0
ODI		1.000	0	0	0	0	NR	0
INDIAN ODI		1.000	0	0	0	0	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US CDL		0.500	0	0	0	NR	NR	0
SRS		0.500	0	0	0	NR	NR	0
MN DEL PLP		1.000	0	0	0	0	NR	0
CDL		0.500	0	0	0	NR	NR	0
US HIST CDL		0.500	0	0	0	NR	NR	0
Local Land Records								
LIENS 2		0.500	0	0	0	NR	NR	0
LUCIS		1.000	0	0	0	0	NR	0
LIENS		0.500	0	0	0	NR	NR	0
Records of Emergency Release Reports								
HMIRS		0.500	0	0	0	NR	NR	0
SPILLS		0.500	0	0	0	NR	NR	0
AGSPILLS		0.500	0	0	0	NR	NR	0
Other Ascertainable Records								
RCRA-NonGen		0.750	0	0	0	0	NR	0
DOT OPS		0.500	0	0	0	NR	NR	0

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
DOD		1.500	1	0	0	0	0	1
FUDS		1.500	0	0	0	0	0	0
CONSENT		1.500	0	0	0	0	0	0
ROD		1.500	0	0	0	0	0	0
UMTRA		1.000	0	0	0	0	NR	0
MINES		0.750	0	0	0	0	NR	0
TRIS		0.500	0	0	0	NR	NR	0
TSCA		0.500	0	0	0	NR	NR	0
FTTS		0.500	0	0	0	NR	NR	0
HIST FTTS		0.500	0	0	0	NR	NR	0
SSTS		0.500	0	0	0	NR	NR	0
ICIS		0.500	0	0	0	NR	NR	0
PADS		0.500	0	0	0	NR	NR	0
MLTS		0.500	0	0	0	NR	NR	0
RADINFO		0.500	0	0	0	NR	NR	0
FINDS		0.500	0	0	0	NR	NR	0
RAATS		0.500	0	0	0	NR	NR	0
MN LS		1.000	0	0	0	0	NR	0
BULK		0.750	0	0	0	0	NR	0
DRYCLEANERS		0.750	0	0	0	0	NR	0
ENF		0.500	0	0	0	NR	NR	0
MN HWS Permit		1.500	0	0	0	0	0	0
AIRS		0.500	0	0	0	NR	NR	0
TIER 2		0.500	0	0	0	NR	NR	0
INDIAN RESERV		1.500	0	0	0	0	0	0
SCRD DRYCLEANERS		1.000	0	0	0	0	NR	0
PCB TRANSFORMER		0.500	0	0	0	NR	NR	0
COAL ASH		1.000	0	0	0	0	NR	0
MDA LIS		0.250	0	0	NR	NR	NR	0

EDR PROPRIETARY RECORDS

EDR Proprietary Records

Manufactured Gas Plants		1.500	0	0	0	0	0	0

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

MAP FINDINGS

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number
DOD **Region** **< 1/8** **1 ft.**	**MASH LAKE** **MASH LAKE (County), MN**	**DOD**	**CUSA103642** **N/A**

DOD:

Feature 1:	Army Corps of Engineers DOD
Feature 2:	Not reported
Feature 3:	Not reported
URL:	Not reported
Name 1:	Mash Lake
Name 2:	Not reported
Name 3:	Not reported
State:	MN
DOD Site:	Yes
Tile name:	MNBIG_STONE

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
MADISON	S106666160	BELLINGHAM FARMERS CO-OP ELEVATOR	RR 2 BOX 122A HIGHWAY 75 N	56256	LUST, LAST
MADISON	S107413285	THOMPSON CHUCK DBA FARM ADVANTAGE	1778 HWY 212	56256	BULK
MADISON	1005429304	FIELDCREST FERTILIZER	RT. 3 BOX 1C	56256	SSTS
MADISON	1011590033	FIELDCREST FERT	RT 3 MADISON MN 56256	56256	ICIS
MADISON	1011595197	HALVORSON MYRON	RTE 3 BOX 40 MADISON MN 5	56256	ICIS
MADISON	1009518678	MUNICIPAL CASTINGS	HWY 40 EAST	56256	FTTS, HIST FTTS
MADISON	A100026233	SCHMIEG OIL CO	HIGHWAY 40	56256	AST
MADISON	S106548741	CENEX (FORMER LAC OUI PARLE COOP)	HIGHWAY 40 / 75	56256	LUST
MADISON	S107730445	MNDOT	HWY 40 E	56256	TIER 2
MADISON	U003961465	MNDOT TRUCK STATION	HIGHWAY 40 E	56256	UST, AST
MADISON	S109841097	MADISON COMPOST SITE PBR	2351 HIGHWAY 40		SWF/LF
MADISON	1000183235	LUND IMPLEMENT CO	HWY 75 N	56256	FINDS, RCRA-NonGen
MADISON	1004729794	MINN KOTA TRANSFER INC	2368 HIGHWAY 75	56256	FINDS, RCRA-CESOG
MADISON	1004731426	MADISON WELDING & REPAIR	2350 HIGHWAY 75	56256	FINDS, RCRA-CESOG
MADISON	S106550168	GAS AND GRUB	HIGHWAY 75 / 40	56256	LUST
MADISON	S107729877	LAC QUI PARLE COOP OIL	HWY 75 / HWY 40	56256	TIER 2
MADISON	U004016829	MADISON GAS & GRUB	HIGHWAY 75 & 40	56256	UST
MADISON	1006197688	LAC QUI PARLE COUNTY DEMOLITION LA	2451 241ST AVE	56256	FINDS, SWF/LF
MADISON	S106548968	MADISON AIRPORT	S HIGHWAY 75	56256	LUST
MADISON	1000624242	MUNICIPAL CASTINGS INC	INDUSTRIAL PARK HIGHWAY 40 E	56256	UST, AST
MADISON	1004535106	FIELDCREST FERT CO	RURAL ROUTE 3 BOX 1 C	56256	SSTS
MADISON	S106404558	MADISON INCINERATOR ASH LANDFILL	SEE LOCATION DESCRIPTION	56256	SWF/LF
MADISON	S109167922	GERHARD WITTNEBEL GRAVEL PIT	SEE LOCATION DESCRIPTION	56256	SWF/LF
MADISON	S106550368	MN DEPT OF TRANSPORTATION TRUCK ST	TH YO E ROUTE 2 BOX 6	56256	LUST
OLIVIA	S106551601	WESTPHAL TRUCKING	W HIGHWAY 212	56227	LUST

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List
National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 06/29/2009
Date Data Arrived at EDR: 07/31/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 52

Source: EPA
Telephone: N/A
Last EDR Contact: 10/14/2009
Next Scheduled EDR Contact: 01/25/2010
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 3
Telephone 215-814-5418

EPA Region 4
Telephone 404-562-8033

EPA Region 5
Telephone 312-886-6686

EPA Region 10
Telephone 206-553-8665

EPA Region 6
Telephone: 214-655-6659

EPA Region 7
Telephone: 913-551-7247

EPA Region 8
Telephone: 303-312-6774

EPA Region 9
Telephone: 415-947-4246

Proposed NPL: Proposed National Priority List Sites
A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 06/29/2009
Date Data Arrived at EDR: 07/31/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 52

Source: EPA
Telephone: N/A
Last EDR Contact: 10/14/2009
Next Scheduled EDR Contact: 01/25/2010
Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens
Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 08/17/2009
Next Scheduled EDR Contact: 11/16/2009
Data Release Frequency: No Update Planned

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Federal Delisted NPL site list

DELISTED NPL: National Priority List Deletions
The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 06/29/2009
Date Data Arrived at EDR: 07/31/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 52

Source: EPA
Telephone: N/A
Last EDR Contact: 10/14/2009
Next Scheduled EDR Contact: 01/25/2010
Data Release Frequency: Quarterly

Federal CERCLIS list

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System
CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 06/30/2009
Date Data Arrived at EDR: 08/11/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 41

Source: EPA
Telephone: 703-412-9810
Last EDR Contact: 09/30/2009
Next Scheduled EDR Contact: 01/11/2010
Data Release Frequency: Quarterly

Federal CERCLIS NFRAP site List

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned
Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Date of Government Version: 06/23/2009
Date Data Arrived at EDR: 09/02/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 19

Source: EPA
Telephone: 703-412-9810
Last EDR Contact: 09/09/2009
Next Scheduled EDR Contact: 12/14/2009
Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report
CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 06/30/2009
Date Data Arrived at EDR: 07/01/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 82

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 08/31/2009
Next Scheduled EDR Contact: 11/30/2009
Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Transporters, Storage and Disposal
RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 11/12/2008	Source: Environmental Protection Agency
Date Data Arrived at EDR: 11/18/2008	Telephone: 312-886-6186
Date Made Active in Reports: 03/16/2009	Last EDR Contact: 10/07/2009
Number of Days to Update: 118	Next Scheduled EDR Contact: 01/18/2010
	Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 11/12/2008	Source: Environmental Protection Agency
Date Data Arrived at EDR: 11/18/2008	Telephone: 312-886-6186
Date Made Active in Reports: 03/16/2009	Last EDR Contact: 10/07/2009
Number of Days to Update: 118	Next Scheduled EDR Contact: 01/18/2010
	Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 11/12/2008	Source: Environmental Protection Agency
Date Data Arrived at EDR: 11/18/2008	Telephone: 312-886-6186
Date Made Active in Reports: 03/16/2009	Last EDR Contact: 10/07/2009
Number of Days to Update: 118	Next Scheduled EDR Contact: 01/18/2010
	Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 11/12/2008	Source: Environmental Protection Agency
Date Data Arrived at EDR: 11/18/2008	Telephone: 312-886-6186
Date Made Active in Reports: 03/16/2009	Last EDR Contact: 10/07/2009
Number of Days to Update: 118	Next Scheduled EDR Contact: 01/18/2010
	Data Release Frequency: Varies

Federal institutional controls / engineering controls registries

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 03/31/2009	Source: Environmental Protection Agency
Date Data Arrived at EDR: 04/22/2009	Telephone: 703-603-0695
Date Made Active in Reports: 05/05/2009	Last EDR Contact: 09/18/2009
Number of Days to Update: 13	Next Scheduled EDR Contact: 12/28/2009
	Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 03/31/2009	Source: Environmental Protection Agency
Date Data Arrived at EDR: 04/22/2009	Telephone: 703-603-0695
Date Made Active in Reports: 05/05/2009	Last EDR Contact: 09/18/2009
Number of Days to Update: 13	Next Scheduled EDR Contact: 12/28/2009
	Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 05/15/2009	Source: National Response Center, United States Coast Guard
Date Data Arrived at EDR: 07/21/2009	Telephone: 202-267-2180
Date Made Active in Reports: 09/21/2009	Last EDR Contact: 10/06/2009
Number of Days to Update: 62	Next Scheduled EDR Contact: 01/18/2010
	Data Release Frequency: Annually

State- and tribal - equivalent NPL

MN PLP: Permanent List of Priorities

The list identifies hazardous waste sites where investigation and cleanup are needed, cleanup is underway, or cleanup has been completed and long-term monitoring or maintenance continues.

Date of Government Version: 08/06/2007	Source: Pollution Control Agency
Date Data Arrived at EDR: 09/07/2007	Telephone: 651-296-6139
Date Made Active in Reports: 10/11/2007	Last EDR Contact: 08/31/2009
Number of Days to Update: 34	Next Scheduled EDR Contact: 11/30/2009
	Data Release Frequency: Annually

State- and tribal - equivalent CERCLIS

SHWS: Superfund Site Information Listing

The SRS database includes all sites that the State Superfund Program is dealing with or has dealt with. The Superfund Program identifies, investigates and determines appropriate cleanup plans for abandoned or uncontrolled hazardous waste sites where a release or potential release of a hazardous substance poses a risk to human health or the environment.

Date of Government Version: 05/20/2009	Source: Minnesota Pollution Control Agency
Date Data Arrived at EDR: 07/02/2009	Telephone: 651-296-6300
Date Made Active in Reports: 07/24/2009	Last EDR Contact: 09/24/2009
Number of Days to Update: 22	Next Scheduled EDR Contact: 12/28/2009
	Data Release Frequency: Annually

State and tribal landfill and/or solid waste disposal site lists

SWF/LF: Permitted Solid Waste Disposal Facilities

Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 08/01/2009	Source: Minnesota Pollution Control Agency
Date Data Arrived at EDR: 08/28/2009	Telephone: 651-296-7276
Date Made Active in Reports: 09/29/2009	Last EDR Contact: 08/28/2009
Number of Days to Update: 32	Next Scheduled EDR Contact: 11/30/2009
	Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

LCP: Closed Landfills Priority List
The Minnesota Legislature enacted a law to manage and clean up the state's closed Mixed Municipal Solid Waste Landfills. Under that law, the MPCA is required to create and periodically revise a priority list of qualified landfills, based on the relative health and environmental risks they present. The MPCA established the first such priority list in December, 1994.

Date of Government Version: 10/01/2008
Date Data Arrived at EDR: 03/27/2009
Date Made Active in Reports: 05/01/2009
Number of Days to Update: 35

Source: Minnesota Pollution Control Agency
Telephone: 651-296-9543
Source: Pollution Control Agency, GIS Section
Telephone: 651-296-7266
Last EDR Contact: 09/18/2009
Next Scheduled EDR Contact: 12/14/2009
Data Release Frequency: Annually

State and tribal leaking storage tank lists

LUST: Leak Sites
Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 08/01/2009
Date Data Arrived at EDR: 08/28/2009
Date Made Active in Reports: 09/29/2009
Number of Days to Update: 32

Source: Minnesota Pollution Control Agency
Telephone: 651-296-6300
Last EDR Contact: 08/28/2009
Next Scheduled EDR Contact: 11/30/2009
Data Release Frequency: Semi-Annually

LAST: Leaking Aboveground Storage Tanks
A listing of leaking aboveground storage tanks.

Date of Government Version: 08/01/2009
Date Data Arrived at EDR: 08/28/2009
Date Made Active in Reports: 09/29/2009
Number of Days to Update: 32

Source: Pollution Control Agency
Telephone: 651-296-6300
Last EDR Contact: 08/28/2009
Next Scheduled EDR Contact: 11/30/2009
Data Release Frequency: Semi-Annually

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 08/20/2009
Date Data Arrived at EDR: 08/21/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 31

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 10/30/2009
Next Scheduled EDR Contact: 02/15/2010
Data Release Frequency: Quarterly

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 02/19/2009
Date Data Arrived at EDR: 02/19/2009
Date Made Active in Reports: 03/16/2009
Number of Days to Update: 25

Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 10/30/2009
Next Scheduled EDR Contact: 02/15/2010
Data Release Frequency: Varies

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 08/24/2009
Date Data Arrived at EDR: 08/26/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 26

Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 10/30/2009
Next Scheduled EDR Contact: 02/15/2010
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 08/24/2009	Source: EPA Region 8
Date Data Arrived at EDR: 09/10/2009	Telephone: 303-312-6271
Date Made Active in Reports: 10/22/2009	Last EDR Contact: 10/30/2009
Number of Days to Update: 42	Next Scheduled EDR Contact: 02/15/2010
	Data Release Frequency: Quarterly

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 08/20/2009	Source: EPA Region 4
Date Data Arrived at EDR: 08/26/2009	Telephone: 404-562-8677
Date Made Active in Reports: 10/22/2009	Last EDR Contact: 10/30/2009
Number of Days to Update: 57	Next Scheduled EDR Contact: 02/15/2010
	Data Release Frequency: Semi-Annually

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 08/21/2009	Source: Environmental Protection Agency
Date Data Arrived at EDR: 10/06/2009	Telephone: 415-972-3372
Date Made Active in Reports: 10/22/2009	Last EDR Contact: 10/30/2009
Number of Days to Update: 16	Next Scheduled EDR Contact: 02/15/2010
	Data Release Frequency: Quarterly

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 03/24/2009	Source: EPA Region 7
Date Data Arrived at EDR: 05/20/2009	Telephone: 913-551-7003
Date Made Active in Reports: 06/17/2009	Last EDR Contact: 08/21/2009
Number of Days to Update: 28	Next Scheduled EDR Contact: 11/16/2009
	Data Release Frequency: Varies

State and tribal registered storage tank lists

UST: Underground Storage Tank Database
Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 08/01/2009	Source: Minnesota Pollution Control Agency
Date Data Arrived at EDR: 08/28/2009	Telephone: 651-649-5451
Date Made Active in Reports: 09/22/2009	Last EDR Contact: 08/28/2009
Number of Days to Update: 25	Next Scheduled EDR Contact: 11/30/2009
	Data Release Frequency: Varies

AST: Aboveground Storage Tanks
Registered Aboveground Storage Tanks.

Date of Government Version: 08/01/2009	Source: Minnesota Pollution Control Agency
Date Data Arrived at EDR: 08/28/2009	Telephone: 651-296-0930
Date Made Active in Reports: 09/23/2009	Last EDR Contact: 08/28/2009
Number of Days to Update: 26	Next Scheduled EDR Contact: 11/30/2009
	Data Release Frequency: Semi-Annually

INDIAN UST R9: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 08/21/2009
Date Data Arrived at EDR: 08/26/2009
Date Made Active in Reports: 10/22/2009
Number of Days to Update: 57

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 10/30/2009
Next Scheduled EDR Contact: 02/15/2010
Data Release Frequency: Quarterly

INDIAN UST R8: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 08/24/2009
Date Data Arrived at EDR: 09/10/2009
Date Made Active in Reports: 10/22/2009
Number of Days to Update: 42

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 10/30/2009
Next Scheduled EDR Contact: 02/15/2010
Data Release Frequency: Quarterly

INDIAN UST R7: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 04/01/2008
Date Data Arrived at EDR: 12/30/2008
Date Made Active in Reports: 03/16/2009
Number of Days to Update: 76

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 08/21/2009
Next Scheduled EDR Contact: 11/16/2009
Data Release Frequency: Varies

INDIAN UST R10: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 08/20/2009
Date Data Arrived at EDR: 08/21/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 31

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 10/30/2009
Next Scheduled EDR Contact: 02/15/2010
Data Release Frequency: Quarterly

INDIAN UST R1: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 02/19/2009
Date Data Arrived at EDR: 02/19/2009
Date Made Active in Reports: 03/16/2009
Number of Days to Update: 25

Source: EPA, Region 1
Telephone: 617-918-1313
Last EDR Contact: 10/30/2009
Next Scheduled EDR Contact: 02/15/2010
Data Release Frequency: Varies

INDIAN UST R6: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 08/24/2009
Date Data Arrived at EDR: 08/26/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 26

Source: EPA Region 6
Telephone: 214-665-7591
Last EDR Contact: 10/30/2009
Next Scheduled EDR Contact: 02/15/2010
Data Release Frequency: Semi-Annually

INDIAN UST R4: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 08/20/2009
Date Data Arrived at EDR: 08/26/2009
Date Made Active in Reports: 10/22/2009
Number of Days to Update: 57

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 10/30/2009
Next Scheduled EDR Contact: 02/15/2010
Data Release Frequency: Semi-Annually

INDIAN UST R5: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 09/08/2008
Date Data Arrived at EDR: 09/19/2008
Date Made Active in Reports: 10/16/2008
Number of Days to Update: 27

Source: EPA Region 5
Telephone: 312-886-6136
Last EDR Contact: 10/22/2009
Next Scheduled EDR Contact: 11/16/2009
Data Release Frequency: Varies

State and tribal institutional control / engineering control registries

INST CONTROL: Site Remediation Section Database
Sites that have an Institutional Control event.

Date of Government Version: 05/20/2009
Date Data Arrived at EDR: 07/02/2009
Date Made Active in Reports: 07/24/2009
Number of Days to Update: 22

Source: Pollution Control Agency
Telephone: 512-296-6300
Last EDR Contact: 09/24/2009
Next Scheduled EDR Contact: 12/28/2009
Data Release Frequency: Quarterly

State and tribal voluntary cleanup sites

VIC: Voluntary Investigation and Cleanup Program
Voluntary Investigation and Cleanup (VIC) Program List.

Date of Government Version: 05/20/2009
Date Data Arrived at EDR: 07/02/2009
Date Made Active in Reports: 07/24/2009
Number of Days to Update: 22

Source: Minnesota Pollution Control Agency
Telephone: 651-296-7291
Last EDR Contact: 09/24/2009
Next Scheduled EDR Contact: 12/28/2009
Data Release Frequency: Quarterly

INDIAN VCP R1: Voluntary Cleanup Priority Listing
A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 04/02/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 10/05/2009
Next Scheduled EDR Contact: 01/18/2010
Data Release Frequency: Varies

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng
A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 04/20/2009
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

State and tribal Brownfields sites

BROWNFIELDS: Petroleum Brownfields Program Sites
Purchasing, selling, or developing property can present a special set of obstacles if the property is contaminated with chemicals. The Petroleum Brownfields Program is one of several programs within the Minnesota Pollution Control Agency (MPCA) designed to help people address these obstacles. The purpose of the Petroleum Brownfields Program is to provide the technical assistance and liability assurance needed to expedite and facilitate the development, transfer, investigation and/or cleanup of property that is contaminated with petroleum.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 09/30/2008	Source: Pollution Control Agency
Date Data Arrived at EDR: 12/09/2008	Telephone: 651-296-7999
Date Made Active in Reports: 02/26/2009	Last EDR Contact: 06/09/2009
Number of Days to Update: 79	Next Scheduled EDR Contact: 09/07/2009
	Data Release Frequency: Varies

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites

Included in the listing are brownfields properties addresses by Cooperative Agreement Recipients and brownfields properties addressed by Targeted Brownfields Assessments. Targeted Brownfields Assessments-EPA's Targeted Brownfields Assessments (TBA) program is designed to help states, tribes, and municipalities--especially those without EPA Brownfields Assessment Demonstration Pilots--minimize the uncertainties of contamination often associated with brownfields. Under the TBA program, EPA provides funding and/or technical assistance for environmental assessments at brownfields sites throughout the country. Targeted Brownfields Assessments supplement and work with other efforts under EPA's Brownfields Initiative to promote cleanup and redevelopment of brownfields. Cooperative Agreement Recipients-States, political subdivisions, territories, and Indian tribes become Brownfields Cleanup Revolving Loan Fund (BCRLF) cooperative agreement recipients when they enter into BCRLF cooperative agreements with the U.S. EPA. EPA selects BCRLF cooperative agreement recipients based on a proposal and application process. BCRLF cooperative agreement recipients must use EPA funds provided through BCRLF cooperative agreement for specified brownfields-related cleanup activities.

Date of Government Version: 10/01/2008	Source: Environmental Protection Agency
Date Data Arrived at EDR: 11/14/2008	Telephone: 202-566-2777
Date Made Active in Reports: 12/23/2008	Last EDR Contact: 09/11/2009
Number of Days to Update: 39	Next Scheduled EDR Contact: 01/11/2010
	Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

ODI: Open Dump Inventory

An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985	Source: Environmental Protection Agency
Date Data Arrived at EDR: 08/09/2004	Telephone: 800-424-9346
Date Made Active in Reports: 09/17/2004	Last EDR Contact: 06/09/2004
Number of Days to Update: 39	Next Scheduled EDR Contact: N/A
	Data Release Frequency: No Update Planned

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations

A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009	Source: EPA, Region 9
Date Data Arrived at EDR: 05/07/2009	Telephone: 415-972-3336
Date Made Active in Reports: 09/21/2009	Last EDR Contact: 09/23/2009
Number of Days to Update: 137	Next Scheduled EDR Contact: 12/21/2009
	Data Release Frequency: Varies

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands

Location of open dumps on Indian land.

Date of Government Version: 12/31/1998	Source: Environmental Protection Agency
Date Data Arrived at EDR: 12/03/2007	Telephone: 703-308-8245
Date Made Active in Reports: 01/24/2008	Last EDR Contact: 08/26/2009
Number of Days to Update: 52	Next Scheduled EDR Contact: 11/23/2009
	Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Local Lists of Hazardous waste / Contaminated Sites

US CDL: Clandestine Drug Labs

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 03/01/2009
Date Data Arrived at EDR: 06/22/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 91

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 03/26/2009
Next Scheduled EDR Contact: 06/22/2009
Data Release Frequency: Quarterly

SRS: Site Remediation Section Database

The database contains site information for sites monitored by the Site Remediation Section.

Date of Government Version: 05/20/2009
Date Data Arrived at EDR: 07/02/2009
Date Made Active in Reports: 07/24/2009
Number of Days to Update: 22

Source: Pollution Control Agency
Telephone: 651-282-5988
Last EDR Contact: 09/24/2009
Next Scheduled EDR Contact: 12/28/2009
Data Release Frequency: Quarterly

MN DEL PLP: Delisted Permanent List of Priorities

This generally means that either no more cleanup at a site is needed or that no state superfund funding is needed for long term monitoring activities.

Date of Government Version: 07/23/2009
Date Data Arrived at EDR: 08/07/2009
Date Made Active in Reports: 08/19/2009
Number of Days to Update: 12

Source: Pollution Control Agency
Telephone: 651-296-6139
Last EDR Contact: 08/31/2009
Next Scheduled EDR Contact: 11/30/2009
Data Release Frequency: Annually

CDL: Clandestine Drug Labs

This data was passively gathered. That is, the DOH asks law enforcement and other agencies to notify them of Clandestine Drug Labs (CDLs). They do not require reporting of events. Therefore the data represents only a subset of all CDLs. This data has not been verified. The DOH has made no attempt to verify that reported CDLs actually occurred. They have no knowledge if the CDL was involved in cooking or just consisted of chemicals associated with Meth production. The reports they receive are that a suspected CDL was seized.

Date of Government Version: 07/29/2009
Date Data Arrived at EDR: 07/30/2009
Date Made Active in Reports: 08/19/2009
Number of Days to Update: 20

Source: Department of Health
Telephone: 651-215-5800
Last EDR Contact: 10/13/2009
Next Scheduled EDR Contact: 01/25/2010
Data Release Frequency: Varies

US HIST CDL: National Clandestine Laboratory Register

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 09/01/2007
Date Data Arrived at EDR: 11/19/2008
Date Made Active in Reports: 03/30/2009
Number of Days to Update: 131

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 03/23/2009
Next Scheduled EDR Contact: 06/22/2009
Data Release Frequency: No Update Planned

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Local Land Records

LIENS 2: CERCLA Lien Information

A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 08/18/2009
Date Data Arrived at EDR: 08/21/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 31

Source: Environmental Protection Agency
Telephone: 202-564-6023
Last EDR Contact: 08/17/2009
Next Scheduled EDR Contact: 11/16/2009
Data Release Frequency: Varies

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 12/09/2005
Date Data Arrived at EDR: 12/11/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 31

Source: Department of the Navy
Telephone: 843-820-7326
Last EDR Contact: 09/08/2009
Next Scheduled EDR Contact: 12/07/2009
Data Release Frequency: Varies

LIENS: Environmental Liens

Sites included in the Site Remediation System Database that have Environmental Liens.

Date of Government Version: 07/06/2006
Date Data Arrived at EDR: 07/07/2006
Date Made Active in Reports: 08/14/2006
Number of Days to Update: 38

Source: Pollution Control Agency
Telephone: 602-282-5988
Last EDR Contact: 09/24/2009
Next Scheduled EDR Contact: 12/28/2009
Data Release Frequency: Quarterly

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System

Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 07/16/2009
Date Data Arrived at EDR: 07/16/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 67

Source: U.S. Department of Transportation
Telephone: 202-366-4555
Last EDR Contact: 10/05/2009
Next Scheduled EDR Contact: 01/11/2010
Data Release Frequency: Annually

SPILLS: Spills Database

Spills reported to the Pollution Control Agency.

Date of Government Version: 08/01/2009
Date Data Arrived at EDR: 08/28/2009
Date Made Active in Reports: 09/29/2009
Number of Days to Update: 32

Source: Minnesota Pollution Control Agency
Telephone: 651-297-8617
Last EDR Contact: 08/28/2009
Next Scheduled EDR Contact: 11/30/2009
Data Release Frequency: Quarterly

AG SPILLS: Department of Agriculture Spills

This data is a list of pesticide/fertilizer incidents reported to have occurred in Minnesota.

Date of Government Version: 09/01/2009
Date Data Arrived at EDR: 09/01/2009
Date Made Active in Reports: 09/29/2009
Number of Days to Update: 28

Source: Department of Agriculture
Telephone: 651-297-3997
Last EDR Contact: 08/31/2009
Next Scheduled EDR Contact: 11/30/2009
Data Release Frequency: Semi-Annually

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Other Ascertainable Records

RCRA-NonGen: RCRA - Non Generators
RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 11/12/2008	Source: Environmental Protection Agency
Date Data Arrived at EDR: 11/18/2008	Telephone: 312-886-6186
Date Made Active in Reports: 03/16/2009	Last EDR Contact: 10/07/2009
Number of Days to Update: 118	Next Scheduled EDR Contact: 01/18/2010
	Data Release Frequency: Varies

DOT OPS: Incident and Accident Data
Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 05/14/2008	Source: Department of Transporation, Office of Pipeline Safety
Date Data Arrived at EDR: 05/28/2008	Telephone: 202-366-4595
Date Made Active in Reports: 08/08/2008	Last EDR Contact: 08/27/2009
Number of Days to Update: 72	Next Scheduled EDR Contact: 11/23/2009
	Data Release Frequency: Varies

DOD: Department of Defense Sites
This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005	Source: USGS
Date Data Arrived at EDR: 11/10/2006	Telephone: 703-692-8801
Date Made Active in Reports: 01/11/2007	Last EDR Contact: 10/23/2009
Number of Days to Update: 62	Next Scheduled EDR Contact: 02/01/2010
	Data Release Frequency: Semi-Annually

FUDS: Formerly Used Defense Sites
The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 12/31/2007	Source: U.S. Army Corps of Engineers
Date Data Arrived at EDR: 09/05/2008	Telephone: 202-528-4285
Date Made Active in Reports: 09/23/2008	Last EDR Contact: 09/30/2009
Number of Days to Update: 18	Next Scheduled EDR Contact: 12/28/2009
	Data Release Frequency: Varies

CONSENT: Superfund (CERCLA) Consent Decrees
Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 04/24/2009	Source: Department of Justice, Consent Decree Library
Date Data Arrived at EDR: 05/19/2009	Telephone: Varies
Date Made Active in Reports: 09/21/2009	Last EDR Contact: 10/06/2009
Number of Days to Update: 125	Next Scheduled EDR Contact: 01/18/2010
	Data Release Frequency: Varies

ROD: Records Of Decision
Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 09/01/2009	Source: EPA
Date Data Arrived at EDR: 09/22/2009	Telephone: 703-416-0223
Date Made Active in Reports: 10/22/2009	Last EDR Contact: 09/22/2009
Number of Days to Update: 30	Next Scheduled EDR Contact: 12/28/2009
	Data Release Frequency: Annually

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

UMTRA: Uranium Mill Tailings Sites
Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 01/05/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 05/08/2009
Number of Days to Update: 1

Source: Department of Energy
Telephone: 505-845-0011
Last EDR Contact: 09/14/2009
Next Scheduled EDR Contact: 12/14/2009
Data Release Frequency: Varies

MINES: Mines Master Index File
Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 05/28/2009
Date Data Arrived at EDR: 06/23/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 90

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959
Last EDR Contact: 09/18/2009
Next Scheduled EDR Contact: 12/21/2009
Data Release Frequency: Semi-Annually

TRIS: Toxic Chemical Release Inventory System
Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2007
Date Data Arrived at EDR: 04/09/2009
Date Made Active in Reports: 06/17/2009
Number of Days to Update: 69

Source: EPA
Telephone: 202-566-0250
Last EDR Contact: 09/14/2009
Next Scheduled EDR Contact: 12/14/2009
Data Release Frequency: Annually

TSCA: Toxic Substances Control Act
Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2002
Date Data Arrived at EDR: 04/14/2006
Date Made Active in Reports: 05/30/2006
Number of Days to Update: 46

Source: EPA
Telephone: 202-260-5521
Last EDR Contact: 10/07/2009
Next Scheduled EDR Contact: 01/11/2010
Data Release Frequency: Every 4 Years

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
Last EDR Contact: 09/10/2009
Next Scheduled EDR Contact: 12/14/2009
Data Release Frequency: Quarterly

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA
Telephone: 202-566-1667
Last EDR Contact: 09/10/2009
Next Scheduled EDR Contact: 12/14/2009
Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing

A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing

A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

SSTS: Section 7 Tracking Systems

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2007
Date Data Arrived at EDR: 05/19/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 125

Source: EPA
Telephone: 202-564-4203
Last EDR Contact: 09/29/2009
Next Scheduled EDR Contact: 01/11/2010
Data Release Frequency: Annually

ICIS: Integrated Compliance Information System

The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 08/21/2009
Date Data Arrived at EDR: 08/27/2009
Date Made Active in Reports: 10/22/2009
Number of Days to Update: 56

Source: Environmental Protection Agency
Telephone: 202-564-5088
Last EDR Contact: 09/28/2009
Next Scheduled EDR Contact: 01/11/2010
Data Release Frequency: Quarterly

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 05/27/2009
Date Data Arrived at EDR: 08/05/2009
Date Made Active in Reports: 09/29/2009
Number of Days to Update: 55

Source: EPA
Telephone: 202-566-0500
Last EDR Contact: 10/21/2009
Next Scheduled EDR Contact: 02/01/2010
Data Release Frequency: Annually

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

MLTS: Material Licensing Tracking System

MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 07/06/2009
Date Data Arrived at EDR: 07/13/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 70

Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
Last EDR Contact: 09/21/2009
Next Scheduled EDR Contact: 12/28/2009
Data Release Frequency: Quarterly

RADINFO: Radiation Information Database

The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 07/28/2009
Date Data Arrived at EDR: 07/28/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 55

Source: Environmental Protection Agency
Telephone: 202-343-9775
Last EDR Contact: 10/16/2009
Next Scheduled EDR Contact: 01/25/2010
Data Release Frequency: Quarterly

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 07/23/2009
Date Data Arrived at EDR: 07/28/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 55

Source: EPA
Telephone: (312) 353-2000
Last EDR Contact: 09/18/2009
Next Scheduled EDR Contact: 12/28/2009
Data Release Frequency: Quarterly

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Date Data Arrived at EDR: 07/03/1995
Date Made Active in Reports: 08/07/1995
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4104
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2007
Date Data Arrived at EDR: 02/19/2009
Date Made Active in Reports: 05/22/2009
Number of Days to Update: 92

Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 09/09/2009
Next Scheduled EDR Contact: 12/07/2009
Data Release Frequency: Biennially

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

LS: List of Sites

The List of Sites includes: Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS), No Further Remedial Action Planned (NFRAP), National Priorities List (NPL), Permanent List of Priorities (PLP), sites delisted from the Permanent List of Priorities (DPLP), Hazardous Waste Permit Unit Project Facilities (HW PERM), List of Permitted Solid Waste Facilities (SW PERM), 1980 Metropolitan Area Waste Disposal Site Inventory (METRO), 1980 Statewide Outstate Dump Inventory (ODI), Voluntary and Investigation Program (VIC), and Closed Landfill Sites Undergoing Cleanup (LCP).

Date of Government Version: 04/22/2009
Date Data Arrived at EDR: 07/14/2009
Date Made Active in Reports: 07/24/2009
Number of Days to Update: 10

Source: Minnesota Pollution Control Agency
Telephone: 651-297-2731
Source: Pollution Control Agency, GIS Section
Telephone: 651-297-2731
Last EDR Contact: 10/08/2009
Next Scheduled EDR Contact: 01/11/2010
Data Release Frequency: Semi-Annually

BULK: Bulk Facilities Database

Facilities that use bulk pesticides and fertilizers

Date of Government Version: 09/23/2009
Date Data Arrived at EDR: 09/23/2009
Date Made Active in Reports: 09/29/2009
Number of Days to Update: 6

Source: Department of Agriculture
Telephone: 651-297-3997
Last EDR Contact: 09/21/2009
Next Scheduled EDR Contact: 11/30/2009
Data Release Frequency: Semi-Annually

DRYCLEANERS: Registered Drycleaning Facilities

A listing of coin-operated laundries and drycleaning; drycleaning plants, except rug cleaning; and industrial launderers.

Date of Government Version: 09/24/2009
Date Data Arrived at EDR: 09/24/2009
Date Made Active in Reports: 10/21/2009
Number of Days to Update: 27

Source: Pollution Control Agency
Telephone: 651-296-6300
Last EDR Contact: 09/23/2009
Next Scheduled EDR Contact: 01/04/2010
Data Release Frequency: Varies

ENFORCEMENT: Generators Associated with Enforcement Logs

Regulatory Compliance, Hazardous Waste Enforcement Log and Hazardous Waste Permit Unit Project Identification List.

Date of Government Version: 07/09/2009
Date Data Arrived at EDR: 07/27/2009
Date Made Active in Reports: 08/19/2009
Number of Days to Update: 23

Source: Minnesota Pollution Control Agency
Telephone: 651-297-8332
Last EDR Contact: 09/23/2009
Next Scheduled EDR Contact: 01/04/2010
Data Release Frequency: Quarterly

MN HWS PERMIT: Active TSD Facilities

Active TSD Facilities.

Date of Government Version: 04/01/2009
Date Data Arrived at EDR: 04/28/2009
Date Made Active in Reports: 05/01/2009
Number of Days to Update: 3

Source: Minnesota Pollution Control Agency
Telephone: 651-297-8470
Last EDR Contact: 09/23/2009
Next Scheduled EDR Contact: 01/04/2010
Data Release Frequency: Annually

AIRS: Permit Contact List

A listing of permitted AIRS facilities.

Date of Government Version: 09/30/2009
Date Data Arrived at EDR: 10/01/2009
Date Made Active in Reports: 10/21/2009
Number of Days to Update: 20

Source: Pollution Control Agency
Telephone: 651-296-7351
Last EDR Contact: 09/25/2009
Next Scheduled EDR Contact: 11/30/2009
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

TIER 2: Tier 2 Facility Listing
A listing of facilities which store or manufacture hazardous materials that submit a chemical inventory report.

Date of Government Version: 12/31/2008	Source: Department of Public Safety
Date Data Arrived at EDR: 03/04/2009	Telephone: 651-296-2233
Date Made Active in Reports: 05/01/2009	Last EDR Contact: 08/31/2009
Number of Days to Update: 58	Next Scheduled EDR Contact: 11/30/2009
	Data Release Frequency: Varies

INDIAN RESERV: Indian Reservations
This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2005	Source: USGS
Date Data Arrived at EDR: 12/08/2006	Telephone: 202-208-3710
Date Made Active in Reports: 01/11/2007	Last EDR Contact: 10/23/2009
Number of Days to Update: 34	Next Scheduled EDR Contact: 02/01/2010
	Data Release Frequency: Semi-Annually

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing
The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 09/09/2009	Source: Environmental Protection Agency
Date Data Arrived at EDR: 09/09/2009	Telephone: 615-532-8599
Date Made Active in Reports: 10/22/2009	Last EDR Contact: 10/26/2009
Number of Days to Update: 43	Next Scheduled EDR Contact: 02/08/2010
	Data Release Frequency: Varies

FEDLAND: Federal and Indian Lands
Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 12/31/2005	Source: U.S. Geological Survey
Date Data Arrived at EDR: 02/06/2006	Telephone: 888-275-8747
Date Made Active in Reports: 01/11/2007	Last EDR Contact: 10/23/2009
Number of Days to Update: 339	Next Scheduled EDR Contact: 02/01/2010
	Data Release Frequency: N/A

PCB TRANSFORMER: PCB Transformer Registration Database
The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 01/01/2008	Source: Environmental Protection Agency
Date Data Arrived at EDR: 02/18/2009	Telephone: 202-566-0517
Date Made Active in Reports: 05/29/2009	Last EDR Contact: 08/21/2009
Number of Days to Update: 100	Next Scheduled EDR Contact: 11/16/2009
	Data Release Frequency: Varies

MDA LIS: Licensing Information System Database Listing
Information provided lists all individuals or companies who hold licenses, certificates and/or permits required by state law and regulated by the Department. Additionally, the LIS lists all companies who must register products with the Department before being used or sold in commercial channels within our state.

Date of Government Version: 09/23/2009	Source: Department of Agriculture
Date Data Arrived at EDR: 09/23/2009	Telephone: 651-201-6000
Date Made Active in Reports: 09/29/2009	Last EDR Contact: 09/21/2009
Number of Days to Update: 6	Next Scheduled EDR Contact: 11/30/2009
	Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

COAL ASH: Coal Ash Disposal Site Listing
A listing of coal ash disposal site locations.

Date of Government Version: 09/17/2009	Source: Pollution Control Agency
Date Data Arrived at EDR: 09/18/2009	Telephone: 651-757-2740
Date Made Active in Reports: 09/29/2009	Last EDR Contact: 09/17/2009
Number of Days to Update: 11	Next Scheduled EDR Contact: 11/30/2009
	Data Release Frequency: Varies

EDR PROPRIETARY RECORDS

EDR Proprietary Records

Manufactured Gas Plants: EDR Proprietary Manufactured Gas Plants
The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A	Source: EDR, Inc.
Date Data Arrived at EDR: N/A	Telephone: N/A
Date Made Active in Reports: N/A	Last EDR Contact: N/A
Number of Days to Update: N/A	Next Scheduled EDR Contact: N/A
	Data Release Frequency: No Update Planned

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

CT MANIFEST: Hazardous Waste Manifest Data
Facility and manifest data. Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a tsd facility.

Date of Government Version: 12/31/2007	Source: Department of Environmental Protection
Date Data Arrived at EDR: 08/26/2009	Telephone: 860-424-3375
Date Made Active in Reports: 09/11/2009	Last EDR Contact: 09/09/2009
Number of Days to Update: 16	Next Scheduled EDR Contact: 12/07/2009
	Data Release Frequency: Annually

NJ MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2008	Source: Department of Environmental Protection
Date Data Arrived at EDR: 05/05/2009	Telephone: N/A
Date Made Active in Reports: 05/22/2009	Last EDR Contact: 10/20/2009
Number of Days to Update: 17	Next Scheduled EDR Contact: 02/01/2010
	Data Release Frequency: Annually

NY MANIFEST: Facility and Manifest Data
Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 07/28/2009	Source: Department of Environmental Conservation
Date Data Arrived at EDR: 08/27/2009	Telephone: 518-402-8651
Date Made Active in Reports: 09/21/2009	Last EDR Contact: 08/27/2009
Number of Days to Update: 25	Next Scheduled EDR Contact: 11/23/2009
	Data Release Frequency: Annually

PA MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2007	Source: Department of Environmental Protection
Date Data Arrived at EDR: 09/11/2008	Telephone: N/A
Date Made Active in Reports: 10/02/2008	Last EDR Contact: 09/08/2009
Number of Days to Update: 21	Next Scheduled EDR Contact: 12/07/2009
	Data Release Frequency: Annually

RI MANIFEST: Manifest information
Hazardous waste manifest information

Date of Government Version: 06/01/2009	Source: Department of Environmental Management
Date Data Arrived at EDR: 06/12/2009	Telephone: 401-222-2797
Date Made Active in Reports: 06/29/2009	Last EDR Contact: 09/14/2009
Number of Days to Update: 17	Next Scheduled EDR Contact: 12/14/2009
	Data Release Frequency: Annually

WI MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2008	Source: Department of Natural Resources
Date Data Arrived at EDR: 07/17/2009	Telephone: N/A
Date Made Active in Reports: 08/10/2009	Last EDR Contact: 09/24/2009
Number of Days to Update: 24	Next Scheduled EDR Contact: 01/04/2010
	Data Release Frequency: Annually

Oil/Gas Pipelines: This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines.

Electric Power Transmission Line Data
Source: PennWell Corporation
Telephone: (800) 823-6277
This map includes information copyrighted by PennWell Corporation. This information is provided on a best effort basis and PennWell Corporation does not guarantee its accuracy nor warrant its fitness for any particular purpose. Such information has been reprinted with the permission of PennWell.

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.
Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.
Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Daycare Centers: Child Care Centers
Source: Department of Human Services
Telephone: 651-296-3971

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 1999 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 and 2005 from the U.S. Fish and Wildlife Service.

STREET AND ADDRESS INFORMATION

GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

MARSH LAKE DAM
MARSH LAKE
MADISON, MN 56256

TARGET PROPERTY COORDINATES

Latitude (North):	45.18820 - 45˚ 11' 17.5"
Longitude (West):	96.1328 - 96˚ 7' 58.1"
Universal Tranverse Mercator:	Zone 14
UTM X (Meters):	725244.4
UTM Y (Meters):	5007640.0
Elevation:	941 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	45096-B2 CORRELL, MN
Most Recent Revision:	1958
East Map:	45096-B1 APPLETON, MN
Most Recent Revision:	1977

EDR's GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principle investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

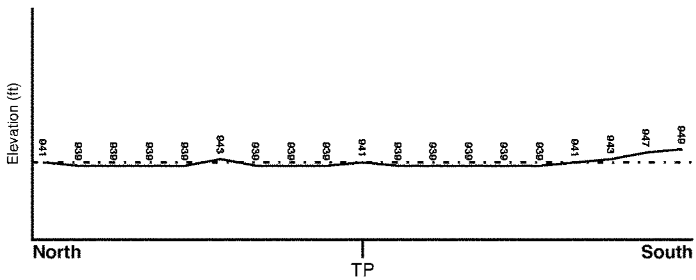
TOPOGRAPHIC INFORMATION

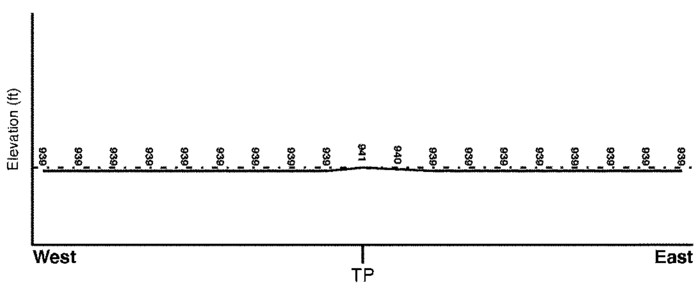
Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

General Topographic Gradient: General East

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES





0 1/2 1 Miles

Target Property Elevation: 941 ft.

Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Target Property County	FEMA Flood Electronic Data
LAC QUI PARLE, MN	YES - refer to the Overview Map and Detail Map

Flood Plain Panel at Target Property: 2702390075B

Additional Panels in search area: 2706520195B

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
CORRELL	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Site-Specific Hydrogeological Data*:

Search Radius: 1.25 miles
Status: Not found

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT		GEOLOGIC AGE IDENTIFICATION	
Era:	Precambrian	Category:	Metamorphic Rocks
System:	Precambrian		
Series:	Orthogneiss and paragneiss		
Code:	Wgn *(decoded above as Era, System & Series)*		

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps. The following information is based on Soil Conservation Service STATSGO data.

Soil Component Name: WATER

Soil Surface Texture: Not reported

Hydrologic Group: Not reported

Soil Drainage Class: Not reported

Hydric Status: Soil does not meet the requirements for a hydric soil.

Corrosion Potential - Uncoated Steel: Not Reported

Depth to Bedrock Min: > 0 inches

Depth to Bedrock Max: > 0 inches

No Layer Information available.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No Wells Found		

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

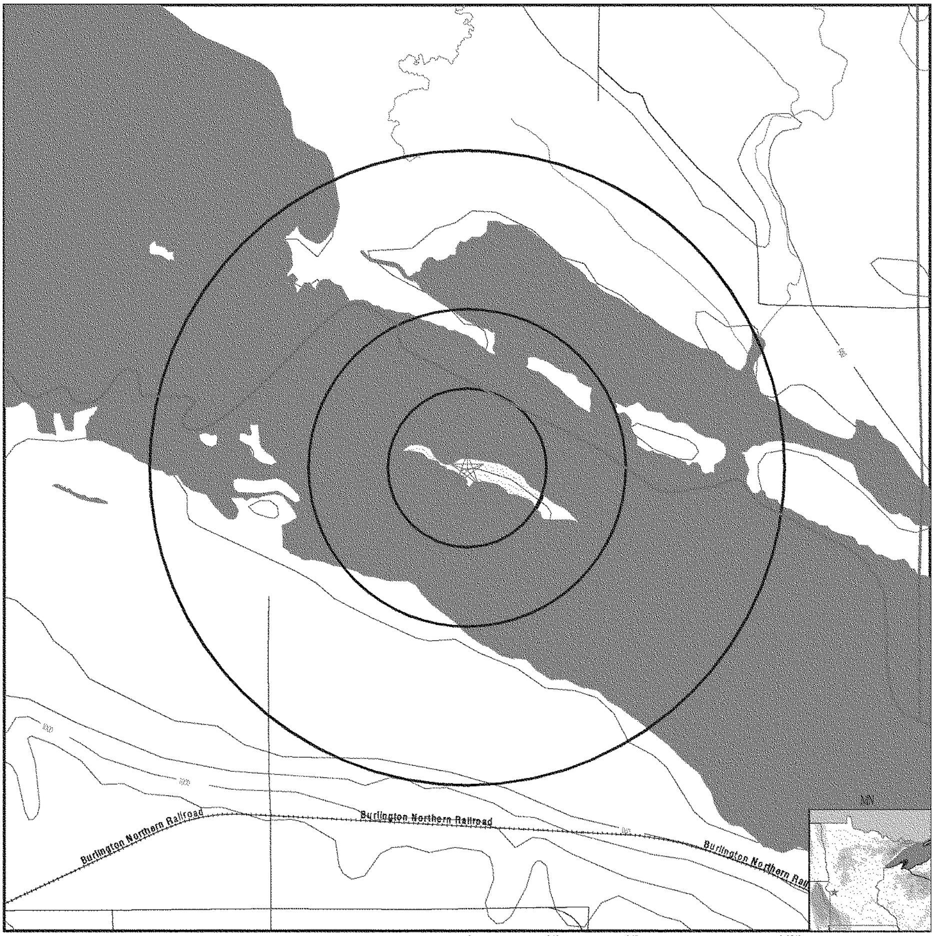
MAP ID	WELL ID	LOCATION FROM TP
No PWS System Found		

Note: PWS System location is not always the same as well location.

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No Wells Found		

PHYSICAL SETTING SOURCE MAP - 2627945.2s



County Boundary
Major Roads
Contour Lines
Earthquake epicenter, Richter 5 or greater
Water Wells
Public Water Supply Wells
Cluster of Multiple Icons

Groundwater Flow Direction
(GI) Indeterminate Groundwater Flow at Location
(GV) Groundwater Flow Varies at Location
(HD) Closest Hydrogeological Data

SITE NAME:	Marsh Lake Dam	CLIENT:	Army Corp of Engineers
ADDRESS:	Marsh Lake	CONTACT:	Grant Riddick
	Madison MN 56256	INQUIRY #:	2627945.2s
LAT/LONG:	45.1882 / 96.1328	DATE:	October 30, 2009 5:19 pm

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

State Database: MN Radon

Radon Test Results

County	Num Sites	< Pci/L	>= 4 Pci/L	% >= 4 Pci/L
LAC QUI PARLE	15	9	6	40%

Federal EPA Radon Zone for LAC QUI PARLE County: 1

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for Zip Code: 56256

Number of sites tested: 1

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	11.300 pCi/L	0%	100%	0%
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	16.000 pCi/L	0%	100%	0%

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5' Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

HYDROLOGIC INFORMATION

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 1999 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 and 2005 from the U.S. Fish and Wildlife Service.

HYDROGEOLOGIC INFORMATION

AQUIFLOW[R] Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services
The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Services, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

Minnesota Groundwater Database
Source: Minnesota Geological Survey County Water Well Index (CWI)
Telephone: 612-627-4780

OTHER STATE DATABASE INFORMATION

RADON

State Database: MN Radon
Source: Department of Health
Telephone: 651-215-0909
Radon Test Results

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

STREET AND ADDRESS INFORMATION

Louisburg Road
Louisburg Road
Correll, MN 56227

Inquiry Number: 3028253.10s
March 31, 2011

The EDR Radius Map™ Report with GeoCheck®

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
Toll Free: 800.352.0050
www.edrnet.com

FORM-PST-TIB

TABLE OF CONTENTS

SECTION **PAGE**

GEOCHECK ADDENDUM

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-05) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

LOUISBURG ROAD
CORRELL, MN 56227

COORDINATES

Latitude (North):	45.216900 - 45˚ 13' 0.8"
Longitude (West):	96.195700 - 96˚ 11' 44.5"
Universal Tranverse Mercator:	Zone 14
UTM X (Meters):	720192.2
UTM Y (Meters):	5010654.5
Elevation:	941 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	45096-B2 CORRELL, MN
Most Recent Revision:	1958

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL.......................... National Priority List
Proposed NPL.............. Proposed National Priority List Sites
NPL LIENS................... Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL............... National Priority List Deletions

EXECUTIVE SUMMARY

Federal CERCLIS list

CERCLIS........................ Comprehensive Environmental Response, Compensation, and Liability Information System
FEDERAL FACILITY.......... Federal Facility Site Information listing

Federal CERCLIS NFRAP site List

CERC-NFRAP................. CERCLIS No Further Remedial Action Planned

Federal RCRA CORRACTS facilities list

CORRACTS.................... Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF................... RCRA - Treatment, Storage and Disposal

Federal RCRA generators list

RCRA-LQG..................... RCRA - Large Quantity Generators
RCRA-SQG..................... RCRA - Small Quantity Generators
RCRA-CESQG................. RCRA - Conditionally Exempt Small Quantity Generator

Federal institutional controls / engineering controls registries

US ENG CONTROLS......... Engineering Controls Sites List
US INST CONTROL.......... Sites with Institutional Controls

Federal ERNS list

ERNS............................ Emergency Response Notification System

State- and tribal - equivalent NPL

MN PLP........................ Permanent List of Priorities

State- and tribal - equivalent CERCLIS

SHWS........................... Superfund Site Information Listing

State and tribal landfill and/or solid waste disposal site lists

SWF/LF......................... Permitted Solid Waste Disposal Facilities
LCP.............................. Closed Landfills Priority List
UNPERM LF.................. Unpermitted Facilities

State and tribal leaking storage tank lists

LUST............................ Leak Sites
LAST............................ Leaking Aboveground Storage Tanks
INDIAN LUST................ Leaking Underground Storage Tanks on Indian Land

State and tribal registered storage tank lists

UST............................. Underground Storage Tank Database

EXECUTIVE SUMMARY

AST........................ Aboveground Storage Tanks
INDIAN UST.................. Underground Storage Tanks on Indian Land
FEMA UST.................... Underground Storage Tank Listing

State and tribal institutional control / engineering control registries

INST CONTROL................ Site Remediation Section Database

State and tribal voluntary cleanup sites

VIC......................... Voluntary Investigation and Cleanup Program
INDIAN VCP.................. Voluntary Cleanup Priority Listing

State and tribal Brownfields sites

BROWNFIELDS................. Petroleum Brownfields Program Sites

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS.............. A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

ODI......................... Open Dump Inventory
DEBRIS REGION 9............. Torres Martinez Reservation Illegal Dump Site Locations
SWRCY....................... Recycling Facilities
INDIAN ODI.................. Report on the Status of Open Dumps on Indian Lands

Local Lists of Hazardous waste / Contaminated Sites

US CDL...................... Clandestine Drug Labs
SRS......................... Site Remediation Section Database
MN DEL PLP.................. Delisted Permanent List of Priorities
CDL......................... Clandestine Drug Labs
US HIST CDL................. National Clandestine Laboratory Register

Local Land Records

LIENS 2..................... CERCLA Lien Information
LUCIS....................... Land Use Control Information System
LIENS....................... Environmental Liens

Records of Emergency Release Reports

HMIRS....................... Hazardous Materials Information Reporting System
SPILLS...................... Spills Database
AGSPILLS.................... Department of Agriculture Spills

Other Ascertainable Records

RCRA-NonGen................. RCRA - Non Generators
DOT OPS..................... Incident and Accident Data

EXECUTIVE SUMMARY

FUDS	Formerly Used Defense Sites
CONSENT	Superfund (CERCLA) Consent Decrees
ROD	Records Of Decision
UMTRA	Uranium Mill Tailings Sites
MINES	Mines Master Index File
TRIS	Toxic Chemical Release Inventory System
TSCA	Toxic Substances Control Act
FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing
SSTS	Section 7 Tracking Systems
ICIS	Integrated Compliance Information System
PADS	PCB Activity Database System
MLTS	Material Licensing Tracking System
RADINFO	Radiation Information Database
FINDS	Facility Index System/Facility Registry System
RAATS	RCRA Administrative Action Tracking System
MN LS	List of Sites
BULK	Bulk Facilities Database
MANIFEST	Hazardous Waste Manifest Data
DRYCLEANERS	Registered Drycleaning Facilities
ENF	Generators Associated with Enforcement Logs
MN HWS Permit	Active TSD Facilities
AIRS	Permit Contact List
TIER 2	Tier 2 Facility Listing
INDIAN RESERV	Indian Reservations
SCRD DRYCLEANERS	State Coalition for Remediation of Drycleaners Listing
PCB TRANSFORMER	PCB Transformer Registration Database
COAL ASH EPA	Coal Combustion Residues Surface Impoundments List
COAL ASH DOE	Sleam-Electric Plan Operation Data
MDA LIS	Licensing Information System Database Listing
AGVIC	Agricultural Voluntary Investigation & Cleanup Listing
WIMN	What's In My Neighborhood
COAL ASH	Coal Ash Disposal Site Listing

EDR PROPRIETARY RECORDS

EDR Proprietary Records

Manufactured Gas Plants...... EDR Proprietary Manufactured Gas Plants

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

EXECUTIVE SUMMARY

ADDITIONAL ENVIRONMENTAL RECORDS

Other Ascertainable Records

DOD: Consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

A review of the DOD list, as provided by EDR, and dated 12/31/2005 has revealed that there is 1 DOD site within approximately 1.5 miles of the target property.

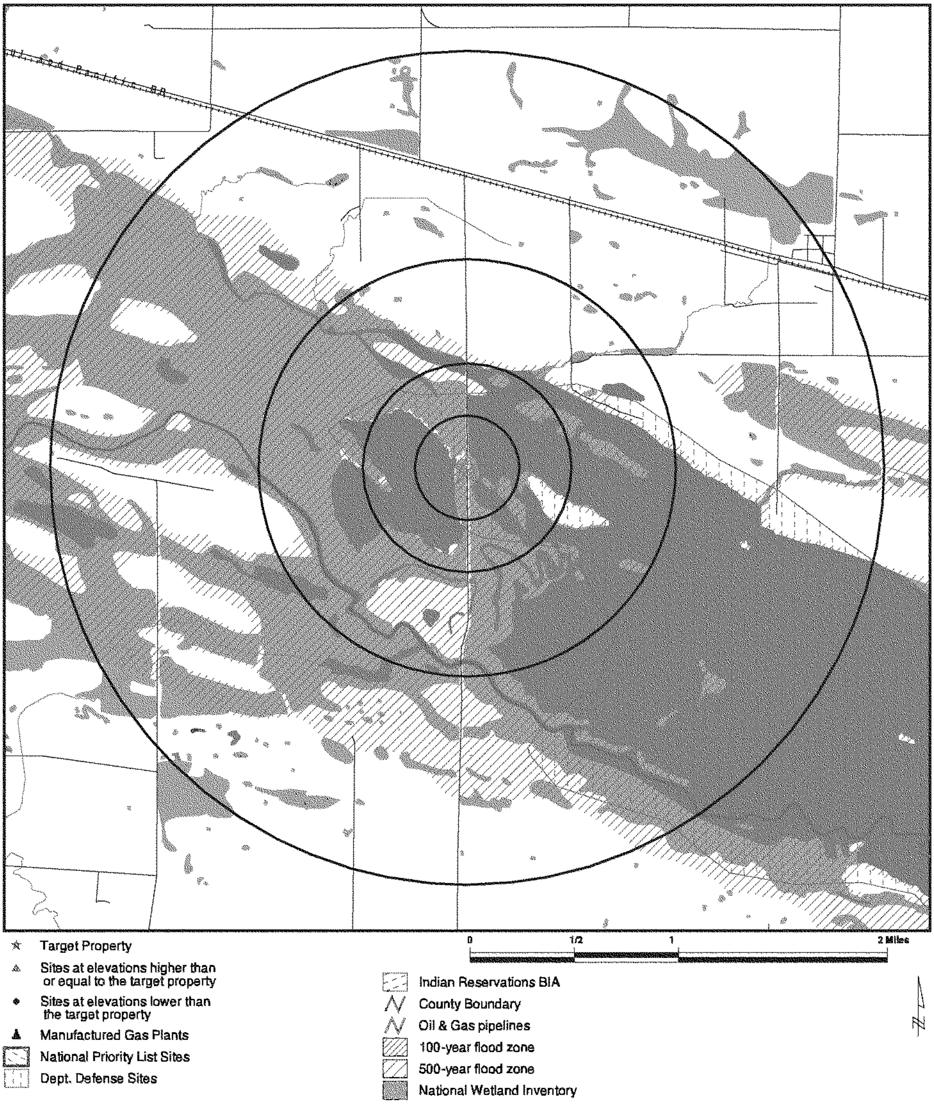
Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
MASH LAKE		0 - 1/8 (0.000 mi.)	0	7

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped. Count: 30 records.

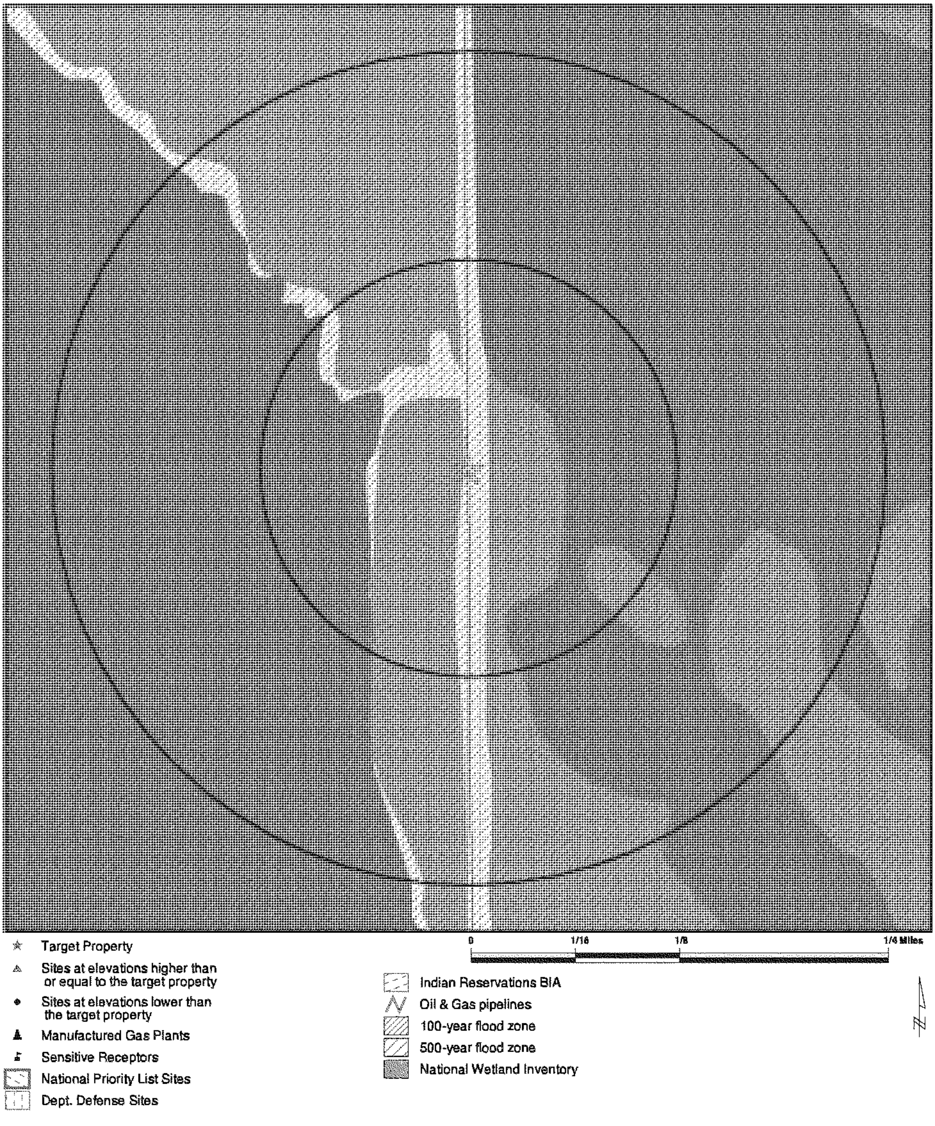
Site Name	Database(s)
CORRELL CITY OF - SW	WIMN
LOUISBURG CITY OF	WIMN
HARVEY HASTAD FARM - SEC 8	WIMN
MIKE KEMEN FARM - SEC 21	WIMN
ROBERT GOERGER FARM - SEC 17	WIMN
ROBERT LUDVIGSON FARM - SEC 23	WIMN
DALE KEMEN FARM - SEC 22	WIMN
RODNEY WEBER FARM - SEC 21	WIMN
THEO NELSON - MAKIN BACON FARM	WIMN
LARRY CLARK FARM - SEC 22	WIMN
A FRAME FARM - SEC 22	WIMN
SCHMIEG OIL CO	WIMN
MNDOT TRUCK STATION	WIMN
CHRISTENSEN FARMS SITE F031	WIMN
MADISON GAS & GRUB	WIMN
LUND IMPLEMENT CO	WIMN
MNDOT TRUCK STATION	UST, AST
MADISON GAS & GRUB	UST
SCHMIEG OIL CO	AST
LUND IMPLEMENT CO	RCRA-NonGen, FINDS
RICHARD LARSON DBA LARSON AUTO BOD	RCRA-CESQG
LOUISBURG FARM ELEV	FINDS
THOMPSON CHUCK DBA FARM ADVANTAGE	BULK
CORRELL DUMP	ODI
HALVORSON MYRON	ICIS
FIELDCREST FERT CO	ICIS
FIELDCREST FERTILIZER	SSTS
FIELDCREST FERT CO	SSTS
MNDOT	TIER 2
LAC QUI PARLE COOP OIL	TIER 2

OVERVIEW MAP - 3028253.10s



SITE NAME:	Louisburg Road	CLIENT:	Army Corp of Engineers
ADDRESS:	Louisburg Road Correll MN 56227	CONTACT:	Ellen Engberg
		INQUIRY #:	3028253.10s
LAT/LONG:	45.2169 / 96.1957	DATE:	March 31, 2011 1:52 pm

DETAIL MAP - 3028253.10s



SITE NAME: Louisburg Road ADDRESS: Louisburg Road Correll MN 56227 LAT/LONG: 45.2169 / 96.1957	CLIENT: Army Corp of Engineers CONTACT: Ellen Engberg INQUIRY #: 3028253.10s DATE: March 31, 2011 1:53 pm

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL		1.500	0	0	0	0	0	0
Proposed NPL		1.500	0	0	0	0	0	0
NPL LIENS		0.500	0	0	0	NR	NR	0
Federal Delisted NPL site list								
Delisted NPL		1.500	0	0	0	0	0	0
Federal CERCLIS list								
CERCLIS		1.000	0	0	0	0	NR	0
FEDERAL FACILITY		1.500	0	0	0	0	0	0
Federal CERCLIS NFRAP site List								
CERC-NFRAP		1.000	0	0	0	0	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS		1.500	0	0	0	0	0	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF		1.000	0	0	0	0	NR	0
Federal RCRA generators list								
RCRA-LQG		0.750	0	0	0	0	NR	0
RCRA-SQG		0.750	0	0	0	0	NR	0
RCRA-CESQG		0.750	0	0	0	0	NR	0
Federal institutional controls / engineering controls registries								
US ENG CONTROLS		1.000	0	0	0	0	NR	0
US INST CONTROL		1.000	0	0	0	0	NR	0
Federal ERNS list								
ERNS		0.500	0	0	0	NR	NR	0
State- and tribal - equivalent NPL								
MN PLP		1.000	0	0	0	0	NR	0
State- and tribal - equivalent CERCLIS								
SHWS		1.500	0	0	0	0	0	0
State and tribal landfill and/or solid waste disposal site lists								
SWF/LF		1.000	0	0	0	0	NR	0
LCP		1.000	0	0	0	0	NR	0
UNPERM LF		1.000	0	0	0	0	NR	0
State and tribal leaking storage tank lists								
LUST		1.000	0	0	0	0	NR	0

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
LAST		1.000	0	0	0	0	NR	0
INDIAN LUST		1.000	0	0	0	0	NR	0
State and tribal registered storage tank lists								
UST		0.750	0	0	0	0	NR	0
AST		0.750	0	0	0	0	NR	0
INDIAN UST		0.750	0	0	0	0	NR	0
FEMA UST		0.750	0	0	0	0	NR	0
State and tribal institutional control / engineering control registries								
INST CONTROL		1.000	0	0	0	0	NR	0
State and tribal voluntary cleanup sites								
VIC		1.000	0	0	0	0	NR	0
INDIAN VCP		1.000	0	0	0	0	NR	0
State and tribal Brownfields sites								
BROWNFIELDS		1.000	0	0	0	0	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS		1.000	0	0	0	0	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
ODI		1.000	0	0	0	0	NR	0
DEBRIS REGION 9		1.000	0	0	0	0	NR	0
SWRCY		1.000	0	0	0	0	NR	0
INDIAN ODI		1.000	0	0	0	0	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US CDL		0.500	0	0	0	NR	NR	0
SRS		0.500	0	0	0	NR	NR	0
MN DEL PLP		1.000	0	0	0	0	NR	0
CDL		0.500	0	0	0	NR	NR	0
US HIST CDL		0.500	0	0	0	NR	NR	0
Local Land Records								
LIENS 2		0.500	0	0	0	NR	NR	0
LUCIS		1.000	0	0	0	0	NR	0
LIENS		0.500	0	0	0	NR	NR	0
Records of Emergency Release Reports								
HMIRS		0.500	0	0	0	NR	NR	0
SPILLS		0.500	0	0	0	NR	NR	0
AGSPILLS		0.500	0	0	0	NR	NR	0
Other Ascertainable Records								
RCRA-NonGen		0.750	0	0	0	0	NR	0

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
DOT OPS		0.500	0	0	0	NR	NR	0
DOD		1.500	1	0	0	0	0	1
FUDS		1.500	0	0	0	0	0	0
CONSENT		1.500	0	0	0	0	0	0
ROD		1.500	0	0	0	0	0	0
UMTRA		1.000	0	0	0	0	NR	0
MINES		0.750	0	0	0	0	NR	0
TRIS		0.500	0	0	0	NR	NR	0
TSCA		0.500	0	0	0	NR	NR	0
FTTS		0.500	0	0	0	NR	NR	0
HIST FTTS		0.500	0	0	0	NR	NR	0
SSTS		0.500	0	0	0	NR	NR	0
ICIS		0.500	0	0	0	NR	NR	0
PADS		0.500	0	0	0	NR	NR	0
MLTS		0.500	0	0	0	NR	NR	0
RADINFO		0.500	0	0	0	NR	NR	0
FINDS		0.500	0	0	0	NR	NR	0
RAATS		0.500	0	0	0	NR	NR	0
MN LS		1.000	0	0	0	0	NR	0
BULK		0.750	0	0	0	0	NR	0
MANIFEST		0.750	0	0	0	0	NR	0
DRYCLEANERS		0.750	0	0	0	0	NR	0
ENF		0.500	0	0	0	NR	NR	0
MN HWS Permit		1.500	0	0	0	0	0	0
AIRS		0.500	0	0	0	NR	NR	0
TIER 2		0.500	0	0	0	NR	NR	0
INDIAN RESERV		1.500	0	0	0	0	0	0
SCRD DRYCLEANERS		1.000	0	0	0	0	NR	0
PCB TRANSFORMER		0.500	0	0	0	NR	NR	0
COAL ASH EPA		1.000	0	0	0	0	NR	0
COAL ASH DOE		0.500	0	0	0	NR	NR	0
MDA LIS		0.250	0	0	NR	NR	NR	0
AGVIC		1.000	0	0	0	0	NR	0
WIMN		1.000	0	0	0	0	NR	0
COAL ASH		1.000	0	0	0	0	NR	0
EDR PROPRIETARY RECORDS								
EDR Proprietary Records								
Manufactured Gas Plants		1.500	0	0	0	0	0	0

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

MAP FINDINGS

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number
DOD **Region** **< 1/8** **1 ft.**	**MASH LAKE** **MASH LAKE (County), MN**	**DOD**	**CUSA103642** **N/A**

DOD:

Feature 1:	Army Corps of Engineers DOD
Feature 2:	Not reported
Feature 3:	Not reported
URL:	Not reported
Name 1:	Mash Lake
Name 2:	Not reported
Name 3:	Not reported
State:	MN
DOD Site:	Yes
Tile name:	MNBIG_STONE

City	EDR ID	Site Name	Site Address	Zip	Database(s)
CORRELL	S110187400	CORRELL CITY OF - SW	119 HWY 7 E	56227	WIMN
CORRELL	1007444677	CORRELL DUMP	.5 MI SOUTH OF JCT STATE HIWAY		QDI
LOUISBURG	S110213812	LOUISBURG CITY OF	RR 1	56256	WIMN
LOUISBURG	1004536276	LOUISBURG FARM ELEV	G D	56256	FINDS
MADISON	S110201656	HARVEY HASTAD FARM - SEC 8	3223 HWY 119	56256	WIMN
MADISON	S110595475	MIKE KEMEN FARM - SEC 21	2375 HWY 212	56256	WIMN
MADISON	S110595818	ROBERT GOERGER FARM - SEC 17	2232 HWY 212	56256	WIMN
MADISON	S110226798	ROBERT LUDVIGSON FARM - SEC 23	1979 HWY 212	56256	WIMN
MADISON	S110189042	DALE KEMEN FARM - SEC 22	2495 HWY 212	56256	WIMN
MADISON	S110227351	RODNEY WEBER FARM - SEC 21	1880 HWY 212	56256	WIMN
MADISON	S107413285	THOMPSON CHUCK DBA FARM ADVANTAGE	1778 HWY 212	56256	BULK
MADISON	S110442903	THEO NELSON - MAKIN BACON FARM	2199 HWY 2L2	56256	WIMN
MADISON	1005429304	FIELDCREST FERTILIZER	RT. 3 BOX 1C	56256	SSTS
MADISON	1011595197	HALVORSON MYRON	RTE 3 BOX 40 MADISON MN 5	56256	ICIS
MADISON	1011590033	FIELDCREST FERT CO	RT 3 MADISON MN 56256	56256	ICIS
MADISON	S110595302	LARRY CLARK FARM - SEC 22	1884 HWY 40	56256	WIMN
MADISON	S110594173	A FRAME FARM - SEC 22	2484 HWY 40	56256	WIMN
MADISON	S110440655	SCHMIEG OIL CO	HWY 40	56256	WIMN
MADISON	S110437043	MNDOT TRUCK STATION	HWY 40 E	56256	WIMN
MADISON	U003961465	MNDOT TRUCK STATION	HWY 40 E	56256	UST, AST
MADISON	A100026233	SCHMIEG OIL CO	HWY 40	56256	AST
MADISON	S110186108	CHRISTENSEN FARMS SITE F031	1596 HWY 40	56256	WIMN
MADISON	S107730445	MNDOT	HWY 40 E	56256	TIER 2
MADISON	1000183235	LUND IMPLEMENT CO	HWY 75 N	56256	RCRA-NonGen, FINDS
MADISON	S110435869	MADISON GAS & GRUB	HWY 75 & HWY	56256	WIMN
MADISON	U004016829	MADISON GAS & GRUB	HWY 75 & HWY	56256	UST
MADISON	1012211489	RICHARD LARSON DBA LARSON AUTO BOD	2356 HIGHWAY 75 S	56256	RCRA-CESQG
MADISON	S110214030	LUND IMPLEMENT CO	HWY 75 N	56256	WIMN
MADISON	S107729877	LAC QUI PARLE COOP OIL	HWY 75 & HWY 40	56256	TIER 2
MADISON	1004535106	FIELDCREST FERT CO	RURAL ROUTE 3 BOX 1 C	56256	SSTS

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List
National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 12/31/2010
Date Data Arrived at EDR: 01/13/2011
Date Made Active in Reports: 01/28/2011
Number of Days to Update: 15

Source: EPA
Telephone: N/A
Last EDR Contact: 01/13/2011
Next Scheduled EDR Contact: 04/25/2011
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 3
Telephone 215-814-5418

EPA Region 4
Telephone 404-562-8033

EPA Region 5
Telephone 312-886-6686

EPA Region 10
Telephone 206-553-8665

EPA Region 6
Telephone: 214-655-6659

EPA Region 7
Telephone: 913-551-7247

EPA Region 8
Telephone: 303-312-6774

EPA Region 9
Telephone: 415-947-4246

Proposed NPL: Proposed National Priority List Sites
A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 12/31/2010
Date Data Arrived at EDR: 01/13/2011
Date Made Active in Reports: 01/28/2011
Number of Days to Update: 15

Source: EPA
Telephone: N/A
Last EDR Contact: 01/13/2011
Next Scheduled EDR Contact: 04/25/2011
Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens
Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 02/14/2011
Next Scheduled EDR Contact: 05/30/2011
Data Release Frequency: No Update Planned

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Federal Delisted NPL site list

DELISTED NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 12/31/2010	Source: EPA
Date Data Arrived at EDR: 01/13/2011	Telephone: N/A
Date Made Active in Reports: 01/28/2011	Last EDR Contact: 01/13/2011
Number of Days to Update: 15	Next Scheduled EDR Contact: 04/25/2011
	Data Release Frequency: Quarterly

Federal CERCLIS list

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System

CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 11/30/2010	Source: EPA
Date Data Arrived at EDR: 12/30/2010	Telephone: 703-412-9810
Date Made Active in Reports: 02/25/2011	Last EDR Contact: 03/01/2011
Number of Days to Update: 57	Next Scheduled EDR Contact: 06/13/2011
	Data Release Frequency: Quarterly

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPAa??s Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 12/10/2010	Source: Environmental Protection Agency
Date Data Arrived at EDR: 01/11/2011	Telephone: 703-603-8704
Date Made Active in Reports: 02/16/2011	Last EDR Contact: 01/11/2011
Number of Days to Update: 36	Next Scheduled EDR Contact: 04/25/2011
	Data Release Frequency: Varies

Federal CERCLIS NFRAP site List

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned

Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Date of Government Version: 10/28/2010	Source: EPA
Date Data Arrived at EDR: 12/01/2010	Telephone: 703-412-9810
Date Made Active in Reports: 02/25/2011	Last EDR Contact: 03/01/2011
Number of Days to Update: 86	Next Scheduled EDR Contact: 06/13/2011
	Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 05/25/2010	Source: EPA
Date Data Arrived at EDR: 06/02/2010	Telephone: 800-424-9346
Date Made Active in Reports: 10/04/2010	Last EDR Contact: 02/14/2011
Number of Days to Update: 124	Next Scheduled EDR Contact: 05/30/2011
	Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 02/17/2010	Source: Environmental Protection Agency
Date Data Arrived at EDR: 02/19/2010	Telephone: 312-886-6186
Date Made Active in Reports: 05/17/2010	Last EDR Contact: 01/06/2011
Number of Days to Update: 87	Next Scheduled EDR Contact: 04/18/2011
	Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 02/17/2010	Source: Environmental Protection Agency
Date Data Arrived at EDR: 02/19/2010	Telephone: 312-886-6186
Date Made Active in Reports: 05/17/2010	Last EDR Contact: 01/06/2011
Number of Days to Update: 87	Next Scheduled EDR Contact: 04/18/2011
	Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 02/17/2010	Source: Environmental Protection Agency
Date Data Arrived at EDR: 02/19/2010	Telephone: 312-886-6186
Date Made Active in Reports: 05/17/2010	Last EDR Contact: 01/06/2011
Number of Days to Update: 87	Next Scheduled EDR Contact: 04/18/2011
	Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 02/17/2010	Source: Environmental Protection Agency
Date Data Arrived at EDR: 02/19/2010	Telephone: 312-886-6186
Date Made Active in Reports: 05/17/2010	Last EDR Contact: 01/06/2011
Number of Days to Update: 87	Next Scheduled EDR Contact: 04/18/2011
	Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Federal institutional controls / engineering controls registries

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 01/05/2011
Date Data Arrived at EDR: 01/14/2011
Date Made Active in Reports: 01/28/2011
Number of Days to Update: 14

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 03/14/2011
Next Scheduled EDR Contact: 06/27/2011
Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 01/05/2011
Date Data Arrived at EDR: 01/14/2011
Date Made Active in Reports: 01/28/2011
Number of Days to Update: 14

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 03/14/2011
Next Scheduled EDR Contact: 06/27/2011
Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 12/31/2010
Date Data Arrived at EDR: 01/07/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 73

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Last EDR Contact: 01/07/2011
Next Scheduled EDR Contact: 04/18/2011
Data Release Frequency: Annually

State- and tribal - equivalent NPL

MN PLP: Permanent List of Priorities

The list identifies hazardous waste sites where investigation and cleanup are needed, cleanup is underway, or cleanup has been completed and long-term monitoring or maintenance continues.

Date of Government Version: 08/01/2009
Date Data Arrived at EDR: 12/16/2009
Date Made Active in Reports: 01/13/2010
Number of Days to Update: 28

Source: Pollution Control Agency
Telephone: 651-296-6139
Last EDR Contact: 02/28/2011
Next Scheduled EDR Contact: 05/30/2011
Data Release Frequency: Annually

State- and tribal - equivalent CERCLIS

SHWS: Superfund Site Information Listing

The SRS database includes all sites that the State Superfund Program is dealing with or has dealt with. The Superfund Program identifies, investigates and determines appropriate cleanup plans for abandoned or uncontrolled hazardous waste sites where a release or potential release of a hazardous substance poses a risk to human health or the environment.

Date of Government Version: 01/03/2011
Date Data Arrived at EDR: 01/06/2011
Date Made Active in Reports: 02/02/2011
Number of Days to Update: 27

Source: Minnesota Pollution Control Agency
Telephone: 651-296-6300
Last EDR Contact: 03/18/2011
Next Scheduled EDR Contact: 06/27/2011
Data Release Frequency: Annually

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

State and tribal landfill and/or solid waste disposal site lists

SWF/LF: Permitted Solid Waste Disposal Facilities

Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 02/01/2011
Date Data Arrived at EDR: 02/15/2011
Date Made Active in Reports: 02/28/2011
Number of Days to Update: 13

Source: Minnesota Pollution Control Agency
Telephone: 651-296-7276
Last EDR Contact: 02/15/2011
Next Scheduled EDR Contact: 05/30/2011
Data Release Frequency: Varies

LCP: Closed Landfills Priority List

The Minnesota Legislature enacted a law to manage and clean up the state's closed Mixed Municipal Solid Waste Landfills. Under that law, the MPCA is required to create and periodically revise a priority list of qualified landfills, based on the relative health and environmental risks they present. The MPCA established the first such priority list in December, 1994.

Date of Government Version: 11/01/2009
Date Data Arrived at EDR: 01/08/2010
Date Made Active in Reports: 01/26/2010
Number of Days to Update: 18

Source: Minnesota Pollution Control Agency
Telephone: 651-296-9543
Source: Pollution Control Agency, GIS Section
Telephone: 651-296-7266
Last EDR Contact: 02/28/2011
Next Scheduled EDR Contact: 06/13/2011
Data Release Frequency: Annually

UNPERM LF: Unpermitted Facilities

These are facilities that have solid waste disposal yet are not permitted.

Date of Government Version: 02/01/2011
Date Data Arrived at EDR: 02/15/2011
Date Made Active in Reports: 02/28/2011
Number of Days to Update: 13

Source: Pollution Control Agency
Telephone: 651-757-2665
Last EDR Contact: 02/15/2011
Next Scheduled EDR Contact: 05/30/2011
Data Release Frequency: Quarterly

State and tribal leaking storage tank lists

LUST: Leak Sites

Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 11/01/2010
Date Data Arrived at EDR: 11/17/2010
Date Made Active in Reports: 11/30/2010
Number of Days to Update: 13

Source: Minnesota Pollution Control Agency
Telephone: 651-296-6300
Last EDR Contact: 03/23/2011
Next Scheduled EDR Contact: 05/30/2011
Data Release Frequency: Semi-Annually

LAST: Leaking Aboveground Storage Tanks

A listing of leaking aboveground storage tanks.

Date of Government Version: 11/01/2010
Date Data Arrived at EDR: 11/17/2010
Date Made Active in Reports: 11/30/2010
Number of Days to Update: 13

Source: Pollution Control Agency
Telephone: 651-296-6300
Last EDR Contact: 03/23/2011
Next Scheduled EDR Contact: 05/30/2011
Data Release Frequency: Semi-Annually

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 02/04/2011
Date Data Arrived at EDR: 02/04/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 45

Source: EPA Region 8
Telephone: 303-312-6271
Last EDR Contact: 01/31/2011
Next Scheduled EDR Contact: 05/16/2011
Data Release Frequency: Quarterly

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 11/04/2009
Date Data Arrived at EDR: 05/04/2010
Date Made Active in Reports: 07/07/2010
Number of Days to Update: 64

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 05/04/2010
Next Scheduled EDR Contact: 05/16/2011
Data Release Frequency: Varies

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 02/03/2011
Date Data Arrived at EDR: 02/04/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 45

Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 01/31/2011
Next Scheduled EDR Contact: 05/16/2011
Data Release Frequency: Varies

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 09/01/2010
Date Data Arrived at EDR: 11/05/2010
Date Made Active in Reports: 01/28/2011
Number of Days to Update: 84

Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 02/03/2011
Next Scheduled EDR Contact: 05/16/2011
Data Release Frequency: Varies

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 02/03/2011
Date Data Arrived at EDR: 02/04/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 45

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 01/31/2011
Next Scheduled EDR Contact: 05/16/2011
Data Release Frequency: Quarterly

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 01/31/2011
Date Data Arrived at EDR: 02/01/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 48

Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 01/31/2011
Next Scheduled EDR Contact: 05/16/2011
Data Release Frequency: Quarterly

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 08/27/2010
Date Data Arrived at EDR: 08/30/2010
Date Made Active in Reports: 10/04/2010
Number of Days to Update: 35

Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 02/16/2011
Next Scheduled EDR Contact: 05/16/2011
Data Release Frequency: Semi-Annually

State and tribal registered storage tank lists

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

UST: Underground Storage Tank Database
Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 02/01/2011	Source: Minnesota Pollution Control Agency
Date Data Arrived at EDR: 02/15/2011	Telephone: 651-649-5451
Date Made Active in Reports: 03/02/2011	Last EDR Contact: 03/23/2011
Number of Days to Update: 15	Next Scheduled EDR Contact: 05/30/2011
	Data Release Frequency: Varies

AST: Aboveground Storage Tanks
Registered Aboveground Storage Tanks.

Date of Government Version: 02/01/2011	Source: Minnesota Pollution Control Agency
Date Data Arrived at EDR: 02/15/2011	Telephone: 651-296-0930
Date Made Active in Reports: 03/02/2011	Last EDR Contact: 03/23/2011
Number of Days to Update: 15	Next Scheduled EDR Contact: 05/30/2011
	Data Release Frequency: Semi-Annually

INDIAN UST R5: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 02/11/2010	Source: EPA Region 5
Date Data Arrived at EDR: 02/11/2010	Telephone: 312-886-6136
Date Made Active in Reports: 04/12/2010	Last EDR Contact: 01/31/2011
Number of Days to Update: 60	Next Scheduled EDR Contact: 05/16/2011
	Data Release Frequency: Varies

INDIAN UST R1: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 09/01/2010	Source: EPA, Region 1
Date Data Arrived at EDR: 11/05/2010	Telephone: 617-918-1313
Date Made Active in Reports: 01/28/2011	Last EDR Contact: 02/03/2011
Number of Days to Update: 84	Next Scheduled EDR Contact: 05/16/2011
	Data Release Frequency: Varies

INDIAN UST R10: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 02/03/2011	Source: EPA Region 10
Date Data Arrived at EDR: 02/04/2011	Telephone: 206-553-2857
Date Made Active in Reports: 03/21/2011	Last EDR Contact: 01/31/2011
Number of Days to Update: 45	Next Scheduled EDR Contact: 05/16/2011
	Data Release Frequency: Quarterly

INDIAN UST R7: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 11/01/2010	Source: EPA Region 7
Date Data Arrived at EDR: 12/02/2010	Telephone: 913-551-7003
Date Made Active in Reports: 01/28/2011	Last EDR Contact: 02/03/2011
Number of Days to Update: 57	Next Scheduled EDR Contact: 05/16/2011
	Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

INDIAN UST R8: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 02/04/2011
Date Data Arrived at EDR: 02/04/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 45

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 01/31/2011
Next Scheduled EDR Contact: 05/16/2011
Data Release Frequency: Quarterly

INDIAN UST R9: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 01/31/2011
Date Data Arrived at EDR: 02/01/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 48

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 01/31/2011
Next Scheduled EDR Contact: 05/16/2011
Data Release Frequency: Quarterly

INDIAN UST R6: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 02/03/2011
Date Data Arrived at EDR: 02/04/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 45

Source: EPA Region 6
Telephone: 214-665-7591
Last EDR Contact: 01/31/2011
Next Scheduled EDR Contact: 05/16/2011
Data Release Frequency: Semi-Annually

INDIAN UST R4: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 08/27/2010
Date Data Arrived at EDR: 08/30/2010
Date Made Active in Reports: 10/04/2010
Number of Days to Update: 35

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 02/16/2011
Next Scheduled EDR Contact: 05/16/2011
Data Release Frequency: Semi-Annually

FEMA UST: Underground Storage Tank Listing
A listing of all FEMA owned underground storage tanks.

Date of Government Version: 01/01/2010
Date Data Arrived at EDR: 02/16/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 55

Source: FEMA
Telephone: 202-646-5797
Last EDR Contact: 01/17/2011
Next Scheduled EDR Contact: 05/02/2011
Data Release Frequency: Varies

State and tribal institutional control / engineering control registries

INST CONTROL: Site Remediation Section Database
Sites that have an Institutional Control event.

Date of Government Version: 01/03/2011
Date Data Arrived at EDR: 01/06/2011
Date Made Active in Reports: 02/02/2011
Number of Days to Update: 27

Source: Pollution Control Agency
Telephone: 512-296-6300
Last EDR Contact: 03/18/2011
Next Scheduled EDR Contact: 06/27/2011
Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

State and tribal voluntary cleanup sites

INDIAN VCP R1: Voluntary Cleanup Priority Listing
A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 09/01/2010
Date Data Arrived at EDR: 01/05/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 75

Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 01/05/2010
Next Scheduled EDR Contact: 04/18/2011
Data Release Frequency: Varies

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng
A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 04/20/2009
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

VIC: Voluntary Investigation and Cleanup Program
Voluntary Investigation and Cleanup (VIC) Program List.

Date of Government Version: 01/03/2011
Date Data Arrived at EDR: 01/06/2011
Date Made Active in Reports: 02/02/2011
Number of Days to Update: 27

Source: Minnesota Pollution Control Agency
Telephone: 651-296-7291
Last EDR Contact: 03/18/2011
Next Scheduled EDR Contact: 06/27/2011
Data Release Frequency: Quarterly

State and tribal Brownfields sites

BROWNFIELDS: Petroleum Brownfields Program Sites
Purchasing, selling, or developing property can present a special set of obstacles if the property is contaminated with chemicals. The Petroleum Brownfields Program is one of several programs within the Minnesota Pollution Control Agency (MPCA) designed to help people address these obstacles. The purpose of the Petroleum Brownfields Program is to provide the technical assistance and liability assurance needed to expedite and facilitate the development, transfer, investigation and/or cleanup of property that is contaminated with petroleum.

Date of Government Version: 09/30/2009
Date Data Arrived at EDR: 03/17/2010
Date Made Active in Reports: 03/31/2010
Number of Days to Update: 14

Source: Pollution Control Agency
Telephone: 651-296-7999
Last EDR Contact: 03/15/2011
Next Scheduled EDR Contact: 06/06/2011
Data Release Frequency: Varies

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Included in the listing are brownfields properties addresses by Cooperative Agreement Recipients and brownfields properties addressed by Targeted Brownfields Assessments. Targeted Brownfields Assessments-EPA's Targeted Brownfields Assessments (TBA) program is designed to help states, tribes, and municipalities--especially those without EPA Brownfields Assessment Demonstration Pilots--minimize the uncertainties of contamination often associated with brownfields. Under the TBA program, EPA provides funding and/or technical assistance for environmental assessments at brownfields sites throughout the country. Targeted Brownfields Assessments supplement and work with other efforts under EPA's Brownfields Initiative to promote cleanup and redevelopment of brownfields. Cooperative Agreement Recipients-States, political subdivisions, territories, and Indian tribes become Brownfields Cleanup Revolving Loan Fund (BCRLF) cooperative agreement recipients when they enter into BCRLF cooperative agreements with the U.S. EPA. EPA selects BCRLF cooperative agreement recipients based on a proposal and application process. BCRLF cooperative agreement recipients must use EPA funds provided through BCRLF cooperative agreement for specified brownfields-related cleanup activities.

Date of Government Version: 12/29/2010	Source: Environmental Protection Agency
Date Data Arrived at EDR: 12/30/2010	Telephone: 202-566-2777
Date Made Active in Reports: 03/21/2011	Last EDR Contact: 03/29/2011
Number of Days to Update: 81	Next Scheduled EDR Contact: 07/11/2011
	Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

ODI: Open Dump Inventory

An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985	Source: Environmental Protection Agency
Date Data Arrived at EDR: 08/09/2004	Telephone: 800-424-9346
Date Made Active in Reports: 09/17/2004	Last EDR Contact: 06/09/2004
Number of Days to Update: 39	Next Scheduled EDR Contact: N/A
	Data Release Frequency: No Update Planned

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations

A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009	Source: EPA, Region 9
Date Data Arrived at EDR: 05/07/2009	Telephone: 415-947-4219
Date Made Active in Reports: 09/21/2009	Last EDR Contact: 03/28/2011
Number of Days to Update: 137	Next Scheduled EDR Contact: 07/11/2011
	Data Release Frequency: No Update Planned

SWRCY: Recycling Facilities

A listing of companies that accept commercial quantities of recyclable materials.

Date of Government Version: 10/07/2010	Source: Pollution Control Agency
Date Data Arrived at EDR: 02/17/2011	Telephone: 651-296-6300
Date Made Active in Reports: 02/24/2011	Last EDR Contact: 02/15/2011
Number of Days to Update: 7	Next Scheduled EDR Contact: 05/30/2011
	Data Release Frequency: Varies

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands

Location of open dumps on Indian land.

Date of Government Version: 12/31/1998	Source: Environmental Protection Agency
Date Data Arrived at EDR: 12/03/2007	Telephone: 703-308-8245
Date Made Active in Reports: 01/24/2008	Last EDR Contact: 02/08/2011
Number of Days to Update: 52	Next Scheduled EDR Contact: 05/23/2011
	Data Release Frequency: Varies

Local Lists of Hazardous waste / Contaminated Sites

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

US CDL: Clandestine Drug Labs
A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 12/03/2010
Date Data Arrived at EDR: 12/30/2010
Date Made Active in Reports: 02/16/2011
Number of Days to Update: 48

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 03/08/2011
Next Scheduled EDR Contact: 06/20/2011
Data Release Frequency: Quarterly

SRS: Site Remediation Section Database
The database contains site information for sites monitored by the Site Remediation Section.

Date of Government Version: 01/03/2011
Date Data Arrived at EDR: 01/06/2011
Date Made Active in Reports: 02/02/2011
Number of Days to Update: 27

Source: Pollution Control Agency
Telephone: 651-282-5988
Last EDR Contact: 01/06/2011
Next Scheduled EDR Contact: 12/27/2010
Data Release Frequency: Quarterly

MN DEL PLP: Delisted Permanent List of Priorities
This generally means that either no more cleanup at a site is needed or that no state superfund funding is needed for long term monitoring activities.

Date of Government Version: 06/30/2010
Date Data Arrived at EDR: 08/27/2010
Date Made Active in Reports: 10/19/2010
Number of Days to Update: 53

Source: Pollution Control Agency
Telephone: 651-296-6139
Last EDR Contact: 02/28/2011
Next Scheduled EDR Contact: 05/30/2011
Data Release Frequency: Annually

CDL: Clandestine Drug Labs
This data was passively gathered. That is, the DOH asks law enforcement and other agencies to notify them of Clandestine Drug Labs (CDLs). They do not require reporting of events. Therefore the data represents only a subset of all CDLs. This data has not been verified. The DOH has made no attempt to verify that reported CDLs actually occurred. They have no knowledge if the CDL was involved in cooking or just consisted of chemicals associated with Meth production. The reports they receive are that a suspected CDL was seized.

Date of Government Version: 01/11/2011
Date Data Arrived at EDR: 01/13/2011
Date Made Active in Reports: 02/02/2011
Number of Days to Update: 20

Source: Department of Health
Telephone: 651-215-5800
Last EDR Contact: 01/10/2011
Next Scheduled EDR Contact: 04/25/2011
Data Release Frequency: Varies

US HIST CDL: National Clandestine Laboratory Register
A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 09/01/2007
Date Data Arrived at EDR: 11/19/2008
Date Made Active in Reports: 03/30/2009
Number of Days to Update: 131

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 03/23/2009
Next Scheduled EDR Contact: 06/22/2009
Data Release Frequency: No Update Planned

Local Land Records

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

LIENS 2: CERCLA Lien Information

A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 11/09/2010
Date Data Arrived at EDR: 11/16/2010
Date Made Active in Reports: 02/16/2011
Number of Days to Update: 92

Source: Environmental Protection Agency
Telephone: 202-564-6023
Last EDR Contact: 01/31/2011
Next Scheduled EDR Contact: 05/16/2011
Data Release Frequency: Varies

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 12/09/2005
Date Data Arrived at EDR: 12/11/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 31

Source: Department of the Navy
Telephone: 843-820-7326
Last EDR Contact: 02/22/2011
Next Scheduled EDR Contact: 06/06/2011
Data Release Frequency: Varies

LIENS: Environmental Liens

Sites included in the Site Remediation System Database that have Environmental Liens.

Date of Government Version: 07/06/2006
Date Data Arrived at EDR: 07/07/2006
Date Made Active in Reports: 08/14/2006
Number of Days to Update: 38

Source: Pollution Control Agency
Telephone: 602-282-5988
Last EDR Contact: 03/18/2011
Next Scheduled EDR Contact: 06/27/2011
Data Release Frequency: Quarterly

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System

Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 12/31/2010
Date Data Arrived at EDR: 01/05/2011
Date Made Active in Reports: 02/25/2011
Number of Days to Update: 51

Source: U.S. Department of Transportation
Telephone: 202-366-4555
Last EDR Contact: 01/05/2011
Next Scheduled EDR Contact: 04/18/2011
Data Release Frequency: Annually

SPILLS: Spills Database

Spills reported to the Pollution Control Agency.

Date of Government Version: 11/01/2010
Date Data Arrived at EDR: 11/17/2010
Date Made Active in Reports: 11/30/2010
Number of Days to Update: 13

Source: Minnesota Pollution Control Agency
Telephone: 651-649-5451
Last EDR Contact: 03/23/2011
Next Scheduled EDR Contact: 05/30/2011
Data Release Frequency: Quarterly

AG SPILLS: Department of Agriculture Spills

This data is a list of pesticide/fertilizer incidents reported to have occurred in Minnesota.

Date of Government Version: 02/15/2011
Date Data Arrived at EDR: 02/16/2011
Date Made Active in Reports: 02/28/2011
Number of Days to Update: 12

Source: Department of Agriculture
Telephone: 651-297-3997
Last EDR Contact: 02/14/2011
Next Scheduled EDR Contact: 05/30/2011
Data Release Frequency: Semi-Annually

Other Ascertainable Records

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

RCRA-NonGen: RCRA - Non Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 02/17/2010
Date Data Arrived at EDR: 02/19/2010
Date Made Active in Reports: 05/17/2010
Number of Days to Update: 87

Source: Environmental Protection Agency
Telephone: 312-886-6186
Last EDR Contact: 01/06/2011
Next Scheduled EDR Contact: 04/18/2011
Data Release Frequency: Varies

DOT OPS: Incident and Accident Data

Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 10/13/2010
Date Data Arrived at EDR: 12/10/2010
Date Made Active in Reports: 02/25/2011
Number of Days to Update: 77

Source: Department of Transporation, Office of Pipeline Safety
Telephone: 202-366-4595
Last EDR Contact: 02/11/2011
Next Scheduled EDR Contact: 05/23/2011
Data Release Frequency: Varies

DOD: Department of Defense Sites

This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 11/10/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 62

Source: USGS
Telephone: 703-692-8801
Last EDR Contact: 01/21/2011
Next Scheduled EDR Contact: 05/02/2011
Data Release Frequency: Semi-Annually

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 08/12/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 112

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 03/15/2011
Next Scheduled EDR Contact: 06/27/2011
Data Release Frequency: Varies

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 10/01/2010
Date Data Arrived at EDR: 10/29/2010
Date Made Active in Reports: 01/28/2011
Number of Days to Update: 91

Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 01/03/2011
Next Scheduled EDR Contact: 04/18/2011
Data Release Frequency: Varies

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 02/25/2011
Date Data Arrived at EDR: 03/16/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 5

Source: EPA
Telephone: 703-416-0223
Last EDR Contact: 03/16/2011
Next Scheduled EDR Contact: 06/27/2011
Data Release Frequency: Annually

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 09/14/2010	Source: Department of Energy
Date Data Arrived at EDR: 10/21/2010	Telephone: 505-845-0011
Date Made Active in Reports: 01/28/2011	Last EDR Contact: 03/04/2011
Number of Days to Update: 99	Next Scheduled EDR Contact: 06/13/2011
	Data Release Frequency: Varies

MINES: Mines Master Index File

Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 08/04/2010	Source: Department of Labor, Mine Safety and Health Administration
Date Data Arrived at EDR: 09/09/2010	Telephone: 303-231-5959
Date Made Active in Reports: 12/02/2010	Last EDR Contact: 03/09/2011
Number of Days to Update: 84	Next Scheduled EDR Contact: 06/20/2011
	Data Release Frequency: Semi-Annually

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2009	Source: EPA
Date Data Arrived at EDR: 12/17/2010	Telephone: 202-566-0250
Date Made Active in Reports: 03/21/2011	Last EDR Contact: 03/01/2011
Number of Days to Update: 94	Next Scheduled EDR Contact: 06/13/2011
	Data Release Frequency: Annually

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2006	Source: EPA
Date Data Arrived at EDR: 09/29/2010	Telephone: 202-260-5521
Date Made Active in Reports: 12/02/2010	Last EDR Contact: 03/29/2011
Number of Days to Update: 64	Next Scheduled EDR Contact: 07/11/2011
	Data Release Frequency: Every 4 Years

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009	Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Date Data Arrived at EDR: 04/16/2009	Telephone: 202-566-1667
Date Made Active in Reports: 05/11/2009	Last EDR Contact: 02/28/2011
Number of Days to Update: 25	Next Scheduled EDR Contact: 06/13/2011
	Data Release Frequency: Quarterly

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009	Source: EPA
Date Data Arrived at EDR: 04/16/2009	Telephone: 202-566-1667
Date Made Active in Reports: 05/11/2009	Last EDR Contact: 02/28/2011
Number of Days to Update: 25	Next Scheduled EDR Contact: 06/13/2011
	Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing

A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006	Source: Environmental Protection Agency
Date Data Arrived at EDR: 03/01/2007	Telephone: 202-564-2501
Date Made Active in Reports: 04/10/2007	Last EDR Contact: 12/17/2007
Number of Days to Update: 40	Next Scheduled EDR Contact: 03/17/2008
	Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing

A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006	Source: Environmental Protection Agency
Date Data Arrived at EDR: 03/01/2007	Telephone: 202-564-2501
Date Made Active in Reports: 04/10/2007	Last EDR Contact: 12/17/2008
Number of Days to Update: 40	Next Scheduled EDR Contact: 03/17/2008
	Data Release Frequency: No Update Planned

SSTS: Section 7 Tracking Systems

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2009	Source: EPA
Date Data Arrived at EDR: 12/10/2010	Telephone: 202-564-4203
Date Made Active in Reports: 02/25/2011	Last EDR Contact: 01/31/2011
Number of Days to Update: 77	Next Scheduled EDR Contact: 05/16/2011
	Data Release Frequency: Annually

ICIS: Integrated Compliance Information System

The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 01/07/2011	Source: Environmental Protection Agency
Date Data Arrived at EDR: 01/21/2011	Telephone: 202-564-5088
Date Made Active in Reports: 03/21/2011	Last EDR Contact: 03/28/2011
Number of Days to Update: 59	Next Scheduled EDR Contact: 07/11/2011
	Data Release Frequency: Quarterly

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 11/01/2010	Source: EPA
Date Data Arrived at EDR: 11/10/2010	Telephone: 202-566-0500
Date Made Active in Reports: 02/16/2011	Last EDR Contact: 01/21/2011
Number of Days to Update: 98	Next Scheduled EDR Contact: 05/02/2011
	Data Release Frequency: Annually

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

MLTS: Material Licensing Tracking System

MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 03/18/2010
Date Data Arrived at EDR: 04/06/2010
Date Made Active in Reports: 05/27/2010
Number of Days to Update: 51

Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
Last EDR Contact: 03/14/2011
Next Scheduled EDR Contact: 06/27/2011
Data Release Frequency: Quarterly

RADINFO: Radiation Information Database

The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 01/11/2011
Date Data Arrived at EDR: 01/13/2011
Date Made Active in Reports: 02/16/2011
Number of Days to Update: 34

Source: Environmental Protection Agency
Telephone: 202-343-9775
Last EDR Contact: 01/13/2011
Next Scheduled EDR Contact: 04/25/2011
Data Release Frequency: Quarterly

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 04/14/2010
Date Data Arrived at EDR: 04/16/2010
Date Made Active in Reports: 05/27/2010
Number of Days to Update: 41

Source: EPA
Telephone: (312) 353-2000
Last EDR Contact: 03/14/2011
Next Scheduled EDR Contact: 06/27/2011
Data Release Frequency: Quarterly

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Date Data Arrived at EDR: 07/03/1995
Date Made Active in Reports: 08/07/1995
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4104
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2007
Date Data Arrived at EDR: 02/25/2010
Date Made Active in Reports: 05/12/2010
Number of Days to Update: 76

Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 03/01/2011
Next Scheduled EDR Contact: 06/13/2011
Data Release Frequency: Biennially

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

LS: List of Sites

The List of Sites includes: Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS), No Further Remedial Action Planned (NFRAP), National Priorities List (NPL), Permanent List of Priorities (PLP), sites delisted from the Permanent List of Priorities (DPLP), Hazardous Waste Permit Unit Project Facilities (HW PERM), List of Permitted Solid Waste Facilities (SW PERM), 1980 Metropolitan Area Waste Disposal Site Inventory (METRO), 1980 Statewide Outstate Dump Inventory (ODI), Voluntary and Investigation Program (VIC), and Closed Landfill Sites Undergoing Cleanup (LCP).

Date of Government Version: 04/22/2009
Date Data Arrived at EDR: 07/14/2009
Date Made Active in Reports: 07/24/2009
Number of Days to Update: 10

Source: Minnesota Pollution Control Agency
Telephone: 651-297-2731
Source: Pollution Control Agency, GIS Section
Telephone: 651-297-2731
Last EDR Contact: 03/28/2011
Next Scheduled EDR Contact: 07/11/2011
Data Release Frequency: Semi-Annually

BULK: Bulk Facilities Database

Facilities that use bulk pesticides and fertilizers

Date of Government Version: 09/14/2010
Date Data Arrived at EDR: 09/16/2010
Date Made Active in Reports: 10/19/2010
Number of Days to Update: 33

Source: Department of Agriculture
Telephone: 651-297-3997
Last EDR Contact: 03/01/2011
Next Scheduled EDR Contact: 05/30/2011
Data Release Frequency: Semi-Annually

MANIFEST: Hazardous Waste Manifest Data

Hazardous waste manifest data.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 07/22/2010
Date Made Active in Reports: 08/17/2010
Number of Days to Update: 26

Source: Pollution Control Agency
Telephone: 651-296-7258
Last EDR Contact: 03/21/2011
Next Scheduled EDR Contact: 07/04/2011
Data Release Frequency: Annually

DRYCLEANERS: Registered Drycleaning Facilities

A listing of coin-operated laundries and drycleaning; drycleaning plants, except rug cleaning; and industrial launderers.

Date of Government Version: 12/21/2010
Date Data Arrived at EDR: 12/23/2010
Date Made Active in Reports: 02/02/2011
Number of Days to Update: 41

Source: Pollution Control Agency
Telephone: 651-296-6300
Last EDR Contact: 03/21/2011
Next Scheduled EDR Contact: 07/04/2011
Data Release Frequency: Varies

ENFORCEMENT: Generators Associated with Enforcement Logs

Regulatory Compliance, Hazardous Waste Enforcement Log and Hazardous Waste Permit Unit Project Identification List.

Date of Government Version: 12/20/2010
Date Data Arrived at EDR: 01/14/2011
Date Made Active in Reports: 02/02/2011
Number of Days to Update: 19

Source: Minnesota Pollution Control Agency
Telephone: 651-297-8332
Last EDR Contact: 03/21/2011
Next Scheduled EDR Contact: 07/04/2011
Data Release Frequency: Quarterly

MN HWS PERMIT: Active TSD Facilities

Active TSD Facilities.

Date of Government Version: 09/21/2010
Date Data Arrived at EDR: 09/24/2010
Date Made Active in Reports: 10/19/2010
Number of Days to Update: 25

Source: Minnesota Pollution Control Agency
Telephone: 651-297-8470
Last EDR Contact: 03/21/2011
Next Scheduled EDR Contact: 07/04/2011
Data Release Frequency: Annually

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

AIRS: Permit Contact List
A listing of permitted AIRS facilities.

Date of Government Version: 12/01/2010	Source: Pollution Control Agency
Date Data Arrived at EDR: 12/02/2010	Telephone: 651-296-7351
Date Made Active in Reports: 12/23/2010	Last EDR Contact: 02/28/2011
Number of Days to Update: 21	Next Scheduled EDR Contact: 05/30/2011
	Data Release Frequency: Varies

TIER 2: Tier 2 Facility Listing
A listing of facilities which store or manufacture hazardous materials that submit a chemical inventory report.

Date of Government Version: 12/31/2009	Source: Department of Public Safety
Date Data Arrived at EDR: 11/16/2010	Telephone: 651-296-2233
Date Made Active in Reports: 11/30/2010	Last EDR Contact: 02/14/2011
Number of Days to Update: 14	Next Scheduled EDR Contact: 05/30/2011
	Data Release Frequency: Varies

INDIAN RESERV: Indian Reservations
This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2005	Source: USGS
Date Data Arrived at EDR: 12/08/2006	Telephone: 202-208-3710
Date Made Active in Reports: 01/11/2007	Last EDR Contact: 01/21/2011
Number of Days to Update: 34	Next Scheduled EDR Contact: 05/02/2011
	Data Release Frequency: Semi-Annually

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing
The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 08/31/2010	Source: Environmental Protection Agency
Date Data Arrived at EDR: 09/01/2010	Telephone: 615-532-8599
Date Made Active in Reports: 12/02/2010	Last EDR Contact: 02/22/2011
Number of Days to Update: 92	Next Scheduled EDR Contact: 05/09/2011
	Data Release Frequency: Varies

WIMN: What's In My Neighborhood
Since 2003, the PCAa??s "Whata??s in My Neighborhood?" database provides information about air quality, hazardous waste, remediation, solid waste, tanks and leaks, and water quality around Minnesota.

Date of Government Version: 01/17/2011	Source: Pollution Control Agency
Date Data Arrived at EDR: 01/18/2011	Telephone: 651-757-2593
Date Made Active in Reports: 02/24/2011	Last EDR Contact: 01/18/2011
Number of Days to Update: 37	Next Scheduled EDR Contact: 05/02/2011
	Data Release Frequency: Varies

COAL ASH DOE: Sleam-Electric Plan Operation Data
A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2005	Source: Department of Energy
Date Data Arrived at EDR: 08/07/2009	Telephone: 202-586-8719
Date Made Active in Reports: 10/22/2009	Last EDR Contact: 01/18/2011
Number of Days to Update: 76	Next Scheduled EDR Contact: 05/02/2011
	Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

MDA LIS: Licensing Information System Database Listing
Information provided lists all individuals or companies who hold licenses, certificates and/or permits required by state law and regulated by the Department. Additionally, the LIS lists all companies who must register products with the Department before being used or sold in commercial channels within our state.

Date of Government Version: 09/14/2010
Date Data Arrived at EDR: 09/16/2010
Date Made Active in Reports: 10/19/2010
Number of Days to Update: 33

Source: Department of Agriculture
Telephone: 651-201-6000
Last EDR Contact: 03/01/2011
Next Scheduled EDR Contact: 05/30/2011
Data Release Frequency: Varies

COAL ASH: Coal Ash Disposal Site Listing
A listing of coal ash disposal site locations.

Date of Government Version: 11/16/2010
Date Data Arrived at EDR: 11/19/2010
Date Made Active in Reports: 11/30/2010
Number of Days to Update: 11

Source: Pollution Control Agency
Telephone: 651-757-2740
Last EDR Contact: 02/28/2011
Next Scheduled EDR Contact: 05/30/2011
Data Release Frequency: Varies

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List
A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 08/17/2010
Date Data Arrived at EDR: 01/03/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 77

Source: Environmental Protection Agency
Telephone: N/A
Last EDR Contact: 03/18/2011
Next Scheduled EDR Contact: 06/27/2011
Data Release Frequency: Varies

FEDLAND: Federal and Indian Lands
Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 02/06/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 339

Source: U.S. Geological Survey
Telephone: 888-275-8747
Last EDR Contact: 01/21/2011
Next Scheduled EDR Contact: 05/02/2011
Data Release Frequency: N/A

AGVIC: Agricultural Voluntary Investigation & Cleanup Listing
A listing of agricultural voluntary investigation & cleanup site locations.

Date of Government Version: 02/15/2011
Date Data Arrived at EDR: 02/16/2011
Date Made Active in Reports: 02/28/2011
Number of Days to Update: 12

Source: Department of Agriculture
Telephone: 651-201-6400
Last EDR Contact: 02/14/2011
Next Scheduled EDR Contact: 05/30/2011
Data Release Frequency: Quarterly

PCB TRANSFORMER: PCB Transformer Registration Database
The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 01/01/2008
Date Data Arrived at EDR: 02/18/2009
Date Made Active in Reports: 05/29/2009
Number of Days to Update: 100

Source: Environmental Protection Agency
Telephone: 202-566-0517
Last EDR Contact: 02/04/2011
Next Scheduled EDR Contact: 05/16/2011
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

EDR PROPRIETARY RECORDS

EDR Proprietary Records

Manufactured Gas Plants: EDR Proprietary Manufactured Gas Plants
The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

CT MANIFEST: Hazardous Waste Manifest Data
Facility and manifest data. Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a tsd facility.

Date of Government Version: 12/31/2007
Date Data Arrived at EDR: 08/26/2009
Date Made Active in Reports: 09/11/2009
Number of Days to Update: 16

Source: Department of Environmental Protection
Telephone: 860-424-3375
Last EDR Contact: 02/25/2011
Next Scheduled EDR Contact: 06/06/2011
Data Release Frequency: Annually

NJ MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 07/22/2010
Date Made Active in Reports: 08/26/2010
Number of Days to Update: 35

Source: Department of Environmental Protection
Telephone: N/A
Last EDR Contact: 01/21/2011
Next Scheduled EDR Contact: 05/02/2011
Data Release Frequency: Annually

NY MANIFEST: Facility and Manifest Data
Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

Date of Government Version: 12/31/2010
Date Data Arrived at EDR: 02/09/2011
Date Made Active in Reports: 03/04/2011
Number of Days to Update: 23

Source: Department of Environmental Conservation
Telephone: 518-402-8651
Last EDR Contact: 02/09/2011
Next Scheduled EDR Contact: 05/23/2011
Data Release Frequency: Annually

PA MANIFEST: Manifest Information
Hazardous waste manifest information.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 12/31/2008
Date Data Arrived at EDR: 12/01/2009
Date Made Active in Reports: 12/14/2009
Number of Days to Update: 13

Source: Department of Environmental Protection
Telephone: 717-783-8990
Last EDR Contact: 02/18/2011
Next Scheduled EDR Contact: 06/06/2011
Data Release Frequency: Annually

RI MANIFEST: Manifest information
Hazardous waste manifest information

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 07/19/2010
Date Made Active in Reports: 08/26/2010
Number of Days to Update: 38

Source: Department of Environmental Management
Telephone: 401-222-2797
Last EDR Contact: 02/28/2011
Next Scheduled EDR Contact: 06/13/2011
Data Release Frequency: Annually

WI MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 07/06/2010
Date Made Active in Reports: 07/26/2010
Number of Days to Update: 20

Source: Department of Natural Resources
Telephone: N/A
Last EDR Contact: 03/21/2011
Next Scheduled EDR Contact: 07/04/2011
Data Release Frequency: Annually

Oil/Gas Pipelines: This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines.

Electric Power Transmission Line Data
Source: Rextag Strategies Corp.
Telephone: (281) 769-2247
U.S. Electric Transmission and Power Plants Systems Digital GIS Data

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Daycare Centers: Child Care Centers
Source: Department of Human Services
Telephone: 651-296-3971

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2009 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 and 2005 from the U.S. Fish and Wildlife Service.

STREET AND ADDRESS INFORMATION

GEOCHECK®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

LOUISBURG ROAD
LOUISBURG ROAD
CORRELL, MN 56227

TARGET PROPERTY COORDINATES

Latitude (North):	45.21690 - 45˚ 13' 0.8"
Longitude (West):	96.1957 - 96˚ 11' 44.5"
Universal Tranverse Mercator:	Zone 14
UTM X (Meters):	720192.2
UTM Y (Meters):	5010654.5
Elevation:	941 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	45096-B2 CORRELL, MN
Most Recent Revision:	1958

EDR's GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principle investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

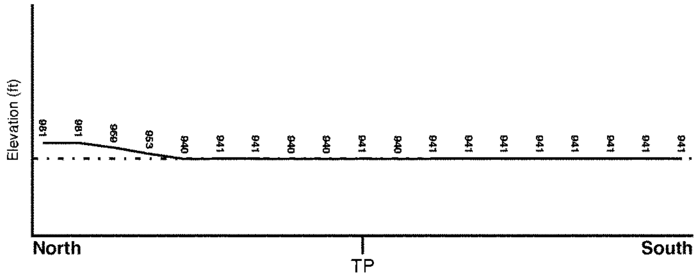
TOPOGRAPHIC INFORMATION

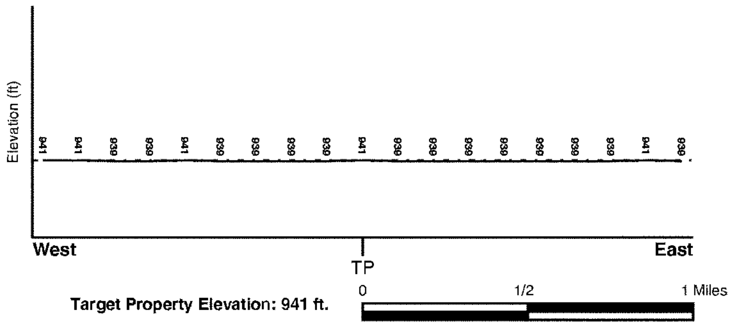
Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

General Topographic Gradient: General North

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES





Target Property Elevation: 941 ft.

Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Target Property County	FEMA Flood Electronic Data
BIG STONE, MN	YES - refer to the Overview Map and Detail Map

Flood Plain Panel at Target Property: 27011C - FEMA DFIRM Flood data

Additional Panels in search area: 27073C - FEMA DFIRM Flood data

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
CORRELL	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Site-Specific Hydrogeological Data*:

Search Radius:	1.25 miles
Status:	Not found

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

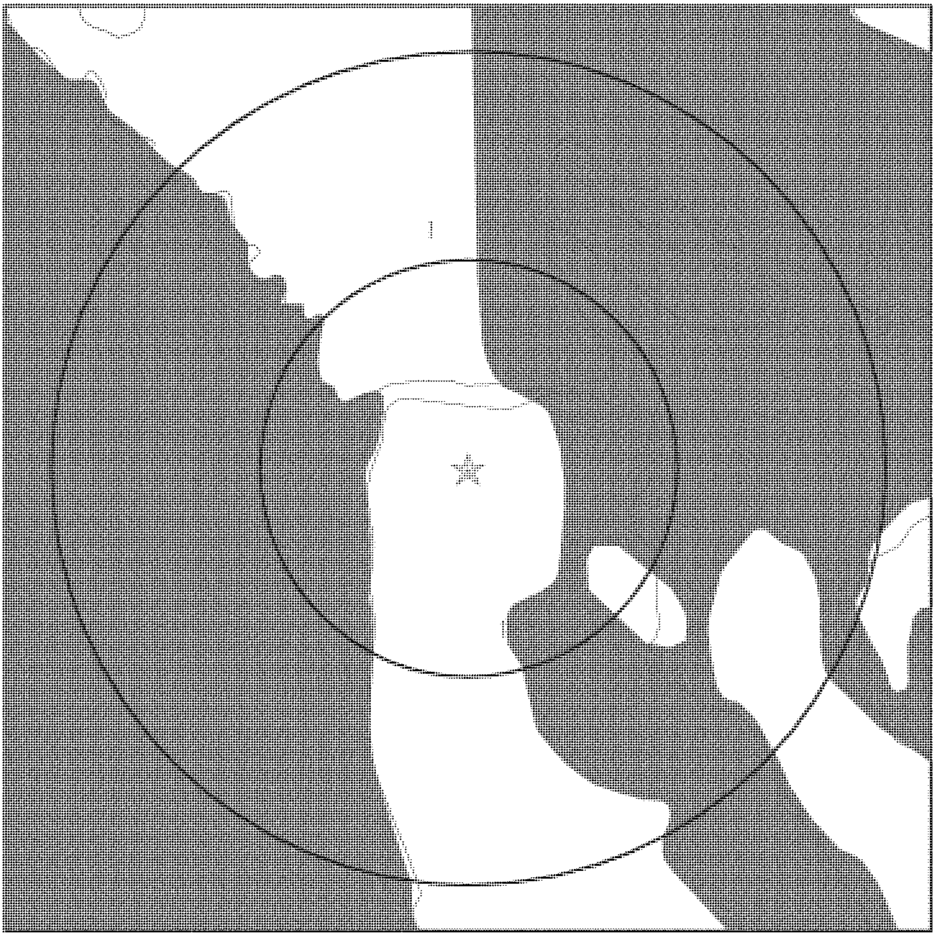
GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT		GEOLOGIC AGE IDENTIFICATION	
Era:	Precambrian	Category:	Plutonic and Intrusive Rocks
System:	Precambrian		
Series:	W granitic rocks		
Code:	Wg *(decoded above as Era, System & Series)*		

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

SSURGO SOIL MAP - 3028253.10s



★ Target Property
SSURGO Soil
Water

SITE NAME: Louisburg Road ADDRESS: Louisburg Road Correll MN 56227 LAT/LONG: 45.2169 / 96.1957	CLIENT: Army Corp of Engineers CONTACT: Ellen Engberg INQUIRY #: 3028253.10s DATE: March 31, 2011 1:53 pm

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. The following information is based on Soil Conservation Service SSURGO data.

Soil Map ID: 1

Soil Component Name: Rauville

Soil Surface Texture: silty clay loam

Hydrologic Group: Class D - Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer.

Soil Drainage Class: Very poorly drained

Hydric Status: All hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
1	0 inches	33 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 1.4	Max: 8.4 Min: 7.4
2	33 inches	59 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 1.4	Max: 8.4 Min: 7.4

Soil Map ID: 2

Soil Component Name: Water

Soil Surface Texture: silty clay loam

Hydrologic Group: Class D - Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer.

Soil Drainage Class:

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Hydric Status: Unknown

Corrosion Potential - Uncoated Steel: Not Reported

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

No Layer Information available.

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No Wells Found		

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

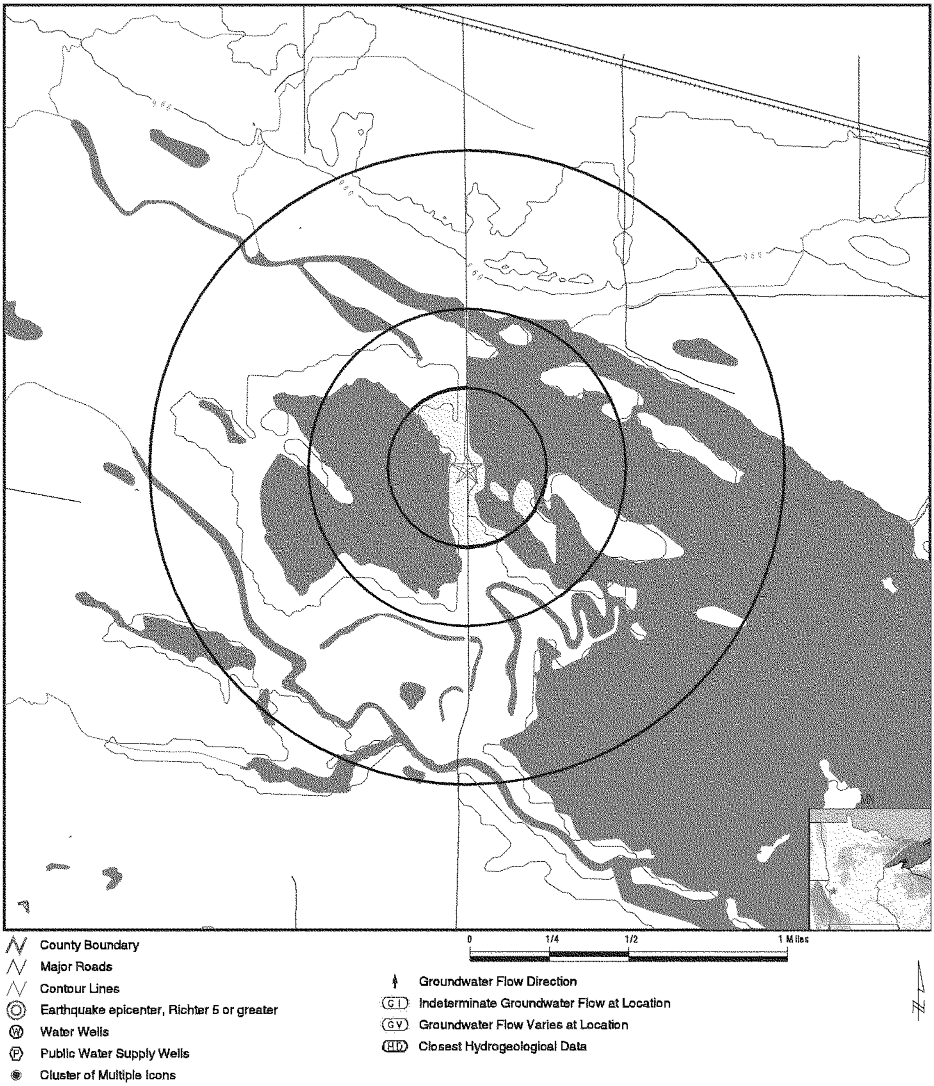
MAP ID	WELL ID	LOCATION FROM TP
No PWS System Found		

Note: PWS System location is not always the same as well location.

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No Wells Found		

PHYSICAL SETTING SOURCE MAP - 3028253.10s



SITE NAME: Louisburg Road ADDRESS: Louisburg Road Correll MN 56227 LAT/LONG: 45.2169 / 96.1957	CLIENT: Army Corp of Engineers CONTACT: Ellen Engberg INQUIRY #: 3028253.10s DATE: March 31, 2011 1:53 pm

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

State Database: MN Radon

Radon Test Results

Zipcode	Num Tests	Minimum	Maximum	Average	# > 4 pCi/L	# < 4 pCi/L
56227	11	0.3	8.3	4.7	6	5

Federal EPA Radon Zone for BIG STONE County: 1

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for BIG STONE COUNTY, MN

Number of sites tested: 3

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	Not Reported	Not Reported	Not Reported	Not Reported
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	4.933 pCi/L	33%	67%	0%

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5' Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

HYDROLOGIC INFORMATION

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2009 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 and 2005 from the U.S. Fish and Wildlife Service.

HYDROGEOLOGIC INFORMATION

AQUIFLOW[R] Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services
The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Services, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

Minnesota Groundwater Database
Source: Minnesota Geological Survey County Water Well Index (CWI)
Telephone: 612-627-4780

OTHER STATE DATABASE INFORMATION

RADON

State Database: MN Radon
Source: Department of Health
Telephone: 651-215-0909
Radon Test Results

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

STREET AND ADDRESS INFORMATION

Appendix G – Cost Estimate

APPENDIX G
COST ENGINEERING

GENERAL

This appendix contains a summary of the detailed cost estimate prepared for the Feasibility Report and Environmental Assessment for the Marsh Lake Ecosystem Restoration Project. This estimate includes real estate; construction; planning, engineering, and design, (PED); and construction management (S and A) costs. The estimate was developed based on review of the project plans, discussions with project delivery team (PDT) members, and quotes from material suppliers in the areas. Guidance for the preparation of the estimate and attachments was obtained from ER-1110-2-1150 Engineering and Design for Civil Works Projects, ER-1110-1-1300 Cost Engineering Policy and General Requirements, and ER-1110-2-1302 Civil Works Cost Engineering.

PRICE LEVEL

The Marsh Lake cost estimate is based on April 2010 prices, unless noted otherwise. Estimated costs are considered fair and reasonable for a prudent and capable contractor and include overhead, profit, and bond. Based on the location of the project, approximately 20 miles northwest of Montevideo, Minnesota, it assumed that no per diem will be required to be included in the estimate. Labor rates used were from published Davis-Bacon wage rates or Minnesota Department of Labor wage rates current in February 2011. Equipment rates are from the MII 2007 equipment manual for region 4. Fuel costs were updated to reflect February 2011 pricing. The 2008 MII cost book was used. Work was assumed to be divided among a prime contractor and three subcontractors. The prime contractor was assumed to be responsible for earthwork, scour protection, and care of water. A structural contractor was assumed to be responsible for construction of concrete structures and bridges. A seeding contractor was used for completing seeding operations while another subcontractor would complete construction of recreation features.

TOTAL PROJECT COST SUMMARY

The total project cost summary for Marsh Lake, shown in the attachments at the end of this appendix, reflects pricing levels for three separate dates. Contingencies are included in these prices. The first date, April 2010, reflects pricing at the time the estimate was developed. The second date, October 2011, reflects escalation of pricing levels to the anticipated funding date. The third is the fully funded pricing level. This reflects pricing escalated to the midpoint of construction for each project feature as well as PED and S and A. Escalation factors were developed from quarterly cost index factors contained in EM 1110-2-1304, revised 30 September 2010.

AVERAGE ANNUAL COSTS

Average annual costs for Marsh Lake were determined by annualizing the sum of the first project costs (construction, preconstruction engineering and design, and construction management) and adding interest accrued during construction with operations and maintenance costs over the life of the project. A table representing these costs is contained in the attachments at the end of this appendix as well as in the main report.

QUANTITIES

Quantities were for the most part provided by the civil engineer for earthwork related tasks and by the structural engineer for the structures. Some quantities, such as temporary access roads downstream of structures, were developed by the cost engineer.

MII COST ESTIMATE

The MII cost estimate, a summary of which is included in the attachments at the end of this appendix, was completed using the version of MII current at the time the estimate was developed. Both electronic and hard copies of the MII cost estimate are available for review. Overhead costs used for prime and subcontractors are based on typical markups for mobilization/demobilization, job office overhead, home office overhead, and bond for the type of work to be done and the size of the project. Profit was based on the use of the weighted guideline method.

Material pricing was determined based on actual price quotes from suppliers in the region for work at the project site or from pricing for recent Corps projects, such as the Montevideo Flood Reduction Project.

Specific tasks as well as crews and associated production rates used for the estimate include standard MII CSI tasks, modified as necessary to meet project requirements, or user defined tasks developed by the cost engineer. Production rates for hauling materials were based on consideration of distance for hauling, anticipated hauling speeds, and estimated time required for loading and unloading.

CONSTRUCTION METHODS

Work required for this project is standard civil works type heavy construction that includes excavation, fill, structural concrete, stoplogs, bridges, riprap and bedding, roadway aggregate, and topsoil and seeding. Tasks required to facilitate construction of project features include construction of temporary access roads, cofferdam construction and dewatering. Standard industry practices are assumed to be used for all work items.

PROJECT DESCRIPTION

The project site is located on Marsh Lake in western Minnesota, approximately 20 miles northwest of Montevideo, Minnesota. The main purpose of the project is to improve habitat in the area by restoring the Pomme de Terre River to its original channel and to provide features to facilitate control of lake levels and to allow fish passage into the lake. An additional feature to control wave action on lakebed sediments was evaluated but not included in the project. Project features, grouped by the civil works work breakdown structure, are discussed in the following paragraphs.

Site access is not considered to be a major concern. Roads access the dam on both sides of the lake.

Obtaining satisfactory materials, including steel, concrete, riprap, and topsoil is not anticipated to be a concern as suppliers have been identified in the region. A borrow site for obtaining impervious fill has been identified in the area immediately north of the dam on the east side of the lake.

No real estate acquisition is required as all the real estate is under the control of the local sponsor or the Corps of Engineers. No utility relocations are required as there are no known utilities in the construction area.

CWBS 02 Relocations:

Two Lane Bridge: A two lane bridge is required to restore flows from the Pomme de Terre River to its original channel and to allow the river to outlet to the Minnesota River on the downstream side of the Marsh Lake Dam rather than into the lake. The bridge is estimated to be approximately 450 feet in length with five spans. The estimated costs for this feature are based on information provided by a Minnesota Department of Transportation (MNDOT) cost estimator specializing in bridge and wall estimates. Documentation for this estimate is contained in the attachments at the end of this appendix.

CWBS 03 Reservoirs:

Fishway: An existing concrete spillway in the Marsh Lake Dam embankment will be modified to facilitate fish passage between Marsh Lake and the Minnesota River downstream. Work includes excavation and backfill in the existing channel downstream of the spillway and placement of rockfill boulders, riprap, and bedding on the downstream side of the structure and on the channel bed to create a series of stepped pools to allow fish access into the lake. Due to the width of the fishway, over 120 feet, it is assumed that access for rock placement will be from embankments to be located on both sides of the fishway as well as from a temporary access road to be placed in the center of the fishway that will be removed when placement of rock is complete.

Modification of Spillway Crest: The crest of the existing concrete overflow weir at the upstream end of the proposed fishway will be lowered to allow fish passage. This will require concrete demolition at the crest of the structure as well as subsequent construction of a one-foot raise from the base of demolition to meet elevation requirements.

Pedestrian Bridge: A pedestrian bridge will be constructed across the fishway structure to allow access along the entire Marsh Lake Dam. Work will include construction of bridge piers and superstructure.

Drawdown Structure: A concrete drawdown structure will be constructed on the west side of the fishway to allow regulation of lake levels. It will be a reinforced concrete structure with an apron, retaining walls, sheetpile cutoffs on the upstream and downstream ends of the structure, ten stoplog bays and associated piers, and a concrete walkway on top of the piers for operation of the stoplog bays and to allow continuous access across the entire dam.

Dewatering of the site for construction of the concrete structure is assumed to be completed by installing a sheetpile cofferdam around the structure pumping out the site with pumps powered by a portable generator.

Riprap and bedding are to be placed in the outlet channel downstream of the structure. As with the fishway, the 120 foot width of the downstream channel will require placement of rock from embankments to be located on both sides of the channel as well as from a temporary access road to be placed approximately at the center of the channel and removed after the rock is placed.

The embankments downstream of the dam on both sides of the fishway and drawdown structure, which were referenced previously in relation to placement of rock in the downstream channels, are to be constructed of impervious fill. The source of the impervious fill, which was noted previously, is a field north of the road raise located on the east side of Marsh Lake. Due to the presence of the spillway on the east side of the drawdown structure inhibiting access across the dam to the drawdown structure, it is assumed that access will be from the west side of the structure. This is likely somewhat conservative as the contractor will likely access the embankment on the east side of the spillway across the crest of the dam.

CWBS 09 Canals and Channels

Initially plans were discussed to include excavation of the original channel alignment for the Pomme de Terre River as part of this project. This option was removed from consideration early in the development of the project. Subsequently, no costs were developed for this feature as part of this report.

CWBS 10 Breakwaters and Seawalls:

Breakwaters placed at three separation locations in Marsh Lake were evaluated as an option for reducing the wave fetch length on the lake, thereby reducing wave action responsible for resuspension of lake bed sediments into the water column. The breakwaters were to consist of rockfill structures with a 4 foot top width and 1V on 5H side slopes. Due to the difficult access issues it was assumed that work will be done here in the winter months when the contractor would be able to access the sites by coming across the ice. For the purposes of development of the estimate, an area construction engineer in the Grand Forks Office of the St. Paul District who has previous experience in hauling material across the Red Lake River in winter was consulted regarding the anticipated effort required to supplement and maintain the haul road. Based on these conversations, it was assumed that construction would have to include crews that would supplement the ice thickness on the haul road prior to initiation of hauling operations and to maintain the roads during hauling operations. This would be done by pumping water out of the lake onto the haul road. This water would freeze thereby increasing the thickness of the ice.

Ultimately this feature was dropped from the proposed project due to the high cost of construction compared to the benefits.

CWBS 11 Levees and Floodwalls:

Fish Pond Levee Breach: This work consists of excavating existing embankment material to allow flow into/out of the abandoned fish pond.

Diversion Dikes A and B: These dikes are to be constructed to restore the Pomme de Terre River to its original channel. Work includes placement of impervious fill from the identified borrow site across the existing cutoff channel at two locations. Diversion dike B will require placement of riprap and bedding on the slopes adjacent to the channel to prevent scouring actions from restoring the cutoff channel.

Road Raise: Construction of the road raise is required to prevent movement of water between Marsh Lake and the Pomme de Terre River through a low area on the east side of Marsh Lake .

Louisburg Road Culverts: Work at Louisburg Road consists of removal of the existing culverts and replacement with concrete culverts with stoplogs to allow regulation of water levels at the northwest end of the lake.

Recreation Features:

Recreation features to be constructed/installed include information kiosks, picnic tables, benches, trash and recycling receptacles, canoe launches, fishing structures, trails, a parking lot, and a toilet vault. It is assumed that recreation features will be standard designs commonly used for such sites.

Site Restoration:

Site restoration is assumed to include removal of temporary access roads as well as placing topsoil and seeding all areas disturbed by the contractor's operations as well as any staging areas. It is assumed that topsoil will be obtained from stripping operations on the project sites.

OPERATIONS AND MAINTENANCE

A detailed operations and maintenance estimate has been developed for this project and is included in this appendix. The estimate includes costs for routine annual inspections to be conducted on a yearly basis as well as formal periodic inspections to be conducted on a five year schedule.

Routine annual maintenance would include mowing of grass and vegetation as well as spraying herbicide on the riprap to prevent growth of woody materials and brush. A 5 year cycle is assumed for maintenance of roadway aggregate. A ten year cycle is assumed for repairs to the riprap, bedding, impervious fill, topsoil, turf, and stoplogs. Maintenance of concrete structures is assumed to be on a longer interval at 20 years and would include repair to concrete as well as painting the railings on the super structure. An operations and maintenance summary is contained in the attachments at the end of this appendix.

CONTINGENCY DISCUSSION

Contingencies for construction, PED, and S and A were estimated using the spreadsheet developed by the Cost Engineering Branch and Directories of Expertise in the Walla Walla District. Although it is preferable to conduct a meeting with the design team to evaluate the factors that determine contingencies used, this was not possible based on present workloads and schedules of team members as well as the complexity and detail of the contingency spreadsheet. Contingencies were first developed by the cost estimator. The spreadsheet was then provided to the team members for their input. Contingencies ranged from approximately 6% to 38%. The contingency risk matrix is shown in the attachments at the end of the appendix.

DESIGN AND CONSTRUCTION SCHEDULE

The anticipated design and construction schedule, shown in the attachments at the end of this appendix, is based on receiving funding for development of plans and specifications at the beginning of FY 2012 and funding for construction the beginning of FY 2013. It is assumed that the planning, engineering, and design phase will be completed by the beginning of the fourth quarter of FY 2012 and contract award would be completed by the end of FY 2012. The total estimated period for construction would be from the beginning of FY 2013 through the end of the 2014 construction season.

The anticipated sequence of construction starts with the construction of those features that result in the rerouting of the Pomme de Terre River to outlet into the Minnesota River downstream of the Marsh Lake Dam. This would aid the construction of subsequent features by diverting the flows from the Pomme de Terre River downstream of Marsh Lake. These features include a two lane bridge, diversion dikes A and B, and a road raise. The estimated construction period for this work would be from October 2012 through the end of June 2013.

Features that control water levels in Marsh Lake or are associated with the dam are assumed to be constructed next. These include construction of a drawdown structure, modifications to the existing spillway to facilitate fish passage into the lake, construction of a pedestrian bridge over the spillway, and construction of downstream embankments for the fishway and drawdown structure. The estimated period of construction for this work is July 2013 through June of 2014.

After the work is completed at the dam, control structures at Louisburg Road at the upstream end of the lake would be constructed along with the fish pond levee breach and recreation features. This work would extend into the fall of 2014.

Although the above construction sequence and schedule is considered to be reasonable based on the amount of time required for construction of each feature and the logical progression of work to optimize efficiency and construction site conditions, it is ultimately up to the contractor to determine progression of work.

APPENDIX G
COST ENGINEERING
ATTACHMENTS

PROJECT COST SUMMARY SHEET

MARSH LAKE ECOSYSTEM RESTORATION PROJECT
PROJECT DEVELOPMENT PLAN: FEASIBILITY STUDY
RECOMMENDED PLAN

PROJECT: MARSH LAKE ECOSYSTEM RESTORATION PROJECT
LOCATION: MARSH LAKE NEAR CORRELL, MINNESOTA
FEATURE: FEASIBILITY STUDY

DISTRICT: ST. PAUL DISTRICT:
POC: CHIEF, COST ENGINEERING, JAMES D. SENTZ
DATE: MARCH 2011

Item	Item Description	Total Estimated Amount	Contingency		Estimated Amount Plus Contingency Date of Estimate: April 2010	Cost Index to Funding Date 1st Quarter 2012	Estimated Amount Plus Contingency Funding Date: October 2011	Midpoint Construction Date of Feature	Index to Construction Midpoint	Fully Funded Amount with Contingencies
			Amount	Percent						
01	Lands & Damages	$10,000			$10,000		$10,200			$10,200
	Admin Costs (includes contingency)	$10,000			$10,000	1.020	$10,200	2nd Quarter, FY2012	1.024	$10,200
02	**Relocations**	**$2,000,000**	**$666,700**		**$2,666,700**		**$2,720,000**			**$2,777,000**
	Two Lane Bridge (Alt Measure 2)	$2,000,000	$666,700	33.3%	$2,666,700	1.020	$2,720,000	2nd Quarter, FY2013	1.041	$2,777,000
03	**Reservoirs**	**$2,889,500**	**$1,026,100**		**$3,915,600**		**$3,993,900**			**$4,146,900**
	Fishway (Alt Measure 3)	$538,200	$179,400	33.3%	$717,600	1.020	$731,900	2nd Quarter, FY2014	1.059	$760,000
	Mod Exist Spillway (Alt Measure 3)	$66,300	$18,000	27.1%	$84,300	1.020	$86,000	2nd Quarter, FY2014	1.059	$89,300
	Ped Bridge over Spillway (Alt Mea 3)	$289,900	$108,700	37.5%	$398,600	1.020	$406,600	2nd Quarter, FY2014	1.059	$422,100
	Drawdown Structure (Alt Mea 4)	$1,724,800	$646,800	37.5%	$2,371,600	1.020	$2,419,000	2nd Quarter, FY2014	1.059	$2,511,700
	Embankments D/S Spillway and Drawdown Structure (Alt Mea 3 & 4)	$270,300	$73,200	27.1%	$343,500	1.020	$350,400	2nd Quarter, FY2014	1.059	$363,800
11	**Levees & Floodwalls**	**$944,200**	**$216,100**		**$1,160,300**		**$1,183,500**			**$1,220,300**
	Fish Pond Levee Breach (Alt Mea 6)	$5,800	$500	8.3%	$6,300	1.020	$6,400	4th Quarter, FY2014	1.068	$6,700
	Diversion Dike A (Alt Mea 2)	$194,600	$44,600	22.9%	$239,200	1.020	$244,000	2nd Quarter, FY2013	1.041	$249,100
	Diversion Dike B (Alt Mea 2)	$64,100	$14,700	22.9%	$78,800	1.020	$80,400	2nd Quarter, FY2013	1.041	$82,100
	Road Raise (Alt Mea 2)	$327,600	$68,300	20.8%	$395,900	1.020	$403,800	2nd Quarter, FY2013	1.041	$412,300
	Louisburg Rd Culverts (Alt Mea 5)	$352,100	$88,000	25.0%	$440,100	1.020	$448,900	4th Quarter, FY2014	1.068	$470,100
14	**Recreational Facilities**	**$339,700**	**$77,800**	**22.9%**	**$417,500**	**1.020**	**$425,800**	**1st Quarter, FY2015**	**1.072**	**$447,800**
30	**Planning, Engineering and Design**	**$926,000**	**$57,900**	**6.3%**	**$983,900**	**1.020**	**$1,003,600**	**2nd Quarter, FY2012**	**1.024**	**$1,007,600**
31	**Construction Management**	**$463,000**	**$154,300**	**33.3%**	**$617,300**	**1.020**	**$629,600**	**1st Quarter, FY2014**	**1.055**	**$651,000**
	Estimated Project Cost	**$7,572,400**	**$2,198,900**	**29%**	**$9,771,300**		**$9,966,600**			**$10,260,800**

Estimated Federal Costs (65%)	**$6,669,500**
Estimated Local Costs (35%)	**$3,591,300**

Marsh Lake – Average Annual Costs

Average annual costs are determined by annualizing the sum of the first project costs (construction, preconstruction engineering and design, and construction management) and adding interest accrued during construction with operations and maintenance costs over the life of the project. A summary of the average annual costs for each project feature is included below:

Marsh Lake Ecosystem Restoration Project

Summary of Average Annual Costs

	Marsh Lake - Alternative Measures						
	2	3	4	5	6	7	Recreation
	Restore Pomme de Terre River to its former channel	Modify Marsh Lake Dam to attain target water levels, construct fishway	Construct drawdown water control structure	Install gated culverts in Louisburg Grade Road	Breach dike at abandoned fish pond	Construct islands in Marsh Lake	All recreation features
Total First Project Costs	$ 3,962,518	$ 1,603,899	$ 2,961,839	$ 519,323	$ 7,605	$ 4,601,013	$ 493,933
Interest During Construction	$ 76,941	$ 39,326	$ 72,358	$ 12,853	$ 192	$ 113,063	$ 12,255
First Project Costs + Interest	$ 4,039,458	$ 1,643,225	$ 3,034,197	$ 532,176	$ 7,797	$ 4,714,075	$ 506,188
Annualized Project Costs	$ 192,080	$ 78,137	$ 144,279	$ 25,305	$ 371	$ 224,159	$ 24,070
Annual O&M Cost	$ 11,325	$ 7,245	$ 13,503	$ 800	$ 50	$ 20,376	$ 2,161
Average Annual Costs	**$ 203,405**	**$ 85,382**	**$ 157,782**	**$ 26,105**	**$ 421**	**$ 244,535**	**$ 26,231**

1. Assumes a 50 year period of analysis - 4.125% interest rate.

New Report

This file reflects the estimated

Estimated by Matthew Bray
Designed by
Prepared by Matthew Bray
Preparation Date 4/1/2010
Effective Date of Pricing 4/1/2010
Estimated Construction Time Days

Right click here and select "Update Field" to build the Table of Contents for this report.

Designed by

Estimated by
Matthew Bray

Prepared by
Matthew Bray

Design Document Feasibility Study
Document Date 3/1/2010

District St. Paul District
Contact Matthew Bray

Budget Year 2010
UOM System Original

Direct Costs
LaborCost
EQCost
MatlCost
SubBidCost
PED
S&A

Timeline/Currency
Preparation Date 4/1/2010
Escalation Date 4/1/2010
Eff. Pricing Date 4/1/2010
Estimated Duration 0 Day(s)

Currency US dollars
Exchange Rate 1.000000

Costbook CB08EB: MII English Cost Book 2008

Labor LNS2009:
Note: - http://www.wdol.gov/ - The website for current up to date, Davis Bacon & Service (FOOH) Labor Rates!!!!! Fringes paid to the laborers are taxable. In a non-union job the whole fringes are taxable. In union job, the vacation pay fringes i: vacation pa;

Labor Rates
LaborCost1
LaborCost2
LaborCost3
LaborCost4

Equipment EP07R04: MII Equipment Region 4r 2007

04 NORTHCENTRAL

Sales Tax	5.10
Working Hours per Year	1,260
Labor Adjustment Factor	1.08
Cost of Money	3.13
Cost of Money Discount	25.00
Tire Recap Cost Factor	1.50
Tire Recap Wear Factor	1.80
Tire Repair Factor	0.15
Equipment Cost Factor	1.00
Standby Depreciation Factor	0.50

Fuel

Electricity	0.088
Gas	3.090
Diesel Off-Road	2.950
Diesel On-Road	3.450

Shipping Rates

Over 0 CWT	13.74
Over 240 CWT	13.53
Over 300 CWT	11.81
Over 400 CWT	10.48
Over 500 CWT	5.92
Over 700 CWT	5.36
Over 800 CWT	4.04

Labor ID: LNS2009 EQ ID: EP07R04 Currency in US dollars TRACES MII Version 3.0

Date	Author	Note
2/18/2011		Project: Marsh Lake Environmental Restoration Project

Design Phase: Feasibility Report and Environmental Assessment

Project Location: Marsh Lake, West Central Minnesota

Brief Summary:This MII file reflects the estimated costs associated with alternative measures considered for restoration of the ecosystem of Marsh Lake. The evaluation considered 7 alternative measures. They are as follows:

Alternative Measure 1: No action (no estimate required).

Alternative Measure 2: Restore Pomme de Terre River to its former channel.

Alternative Measure 3: Modify Marsh Lake Dam to attain target water levels and construct fishway.

Alternative Measure 4: Construct drawdown water control structure.

Alternative Measure 5: Install gated culverts in Louisburg Grade Road.

Alternative Measure 6: Breach dike at abandoned fish pond.

Alternative Measure 7: Construct islands in Marsh Lake.

These measures are identified in this MII estimate and are discussed in detail in the Marsh Lake report.

Acquisition Strategy: This project is assumed to be contracted under a small business acquisition program. The specific program has not been identified at this time. Potential increased costs due to this procurement method are reflected in the spreadsheet used to develop the project contingencies.

MII References Used:

The 2008 MII cost book was used to develop the estimate.

Equipment rates are based on the 2007 equipment manual for Region 4 (Midwest).

Fuel costs are based on pricing on the U.S. Energy Information Administration website for the week of 02/14/11 .

Cost of money is based on published rates from the U.S.Treasury Department for the period from 1/1/11 through 6/30/11.

Labor rates are based on Davis-Bacon wage rates or Minnesota Department of Labor wage rates for Big Stone/Lac Qui Parle/Swift Counties current for 02/17/11. For wage rates that were not found in either source, the MII default wage rates were used.

Contractor Assumptions: Work is assumed to be divided up between the prime contractor and subcontractors as follows:

Prime Contractor:

The prime is assumed to do most of the work, including earthwork, scour protection, and care of water.

Subcontractors:

Labor ID: LNS2009 EQ ID: EP07R04 Currency in US dollars TRACES MII Version 3.0

Date	Author	Note
		Structural Contractor is assumed to build the concrete structures and bridges.
		Seeding Contractor is assumed to do the seeding for the project.
		Recreation Contractor is assumed to construct the recreation features.

Direct Cost Markups	**Category**	**Method**
Productivity	Productivity	Productivity
Overtime	Overtime	Overtime

	Days/Week	*Hours/Shift*	*Shifts/Day*	*1st Shift*	*2nd Shift*	*3rd Shift*
Standard	*5.00*	*8.00*	*1.00*	*8.00*	*0.00*	*0.00*
Actual	*5.00*	*8.00*	*1.00*	*10.00*	*0.00*	*0.00*

Day	*OT Factor*	*Working*	*OT Percent*	*FCCM Percent*
Monday	*1.50*	*Yes*	*10.00*	*(20.00)*
Tuesday	*1.50*	*Yes*		
Wednesday	*1.50*	*Yes*		
Thursday	*1.50*	*Yes*		
Friday	*1.50*	*Yes*		
Saturday	*1.50*	*No*		
Sunday	*2.00*	*No*		

Sales Tax	TaxAdj	Running % on Selected Costs
MatlCost		

Contractor Markups	**Category**	**Method**
MOB/DEMOB	MiscContract	Direct %
JOOH (Small Tools)	Allowance	% of Labor
JOOH	JOOH	JOOH (Calculated)
JOOH PRIME	JOOH	Running %
JOOH SUBS	Allowance	Running %
HOOH	HOOH	Running %
HOOH PRIME	HOOH	Direct %
HOOH SUBS	Allowance	Running %
Profit	Profit	Running %
Bond	Bond	Bond Table

Class B, Tiered, 24 months, 1.00% Surcharge

Contract Price	*Bond Rate*
500,000	*15.84*
2,000,000	*9.57*
2,500,000	*7.59*
2,500,000	*6.93*
100,000,000,000	*6.34*

Excise Tax	Excise	Running %
PROFIT PRIME	Allowance	Running %

Owner Markups	**Category**	**Method**
Escalation	Escalation	Escalation

StartDate	*StartIndex*	*EndDate*	*EndIndex*	*Escalation*
2/26/2010	*0.00*	*2/26/2010*	*0.00*	*0.00*

Labor ID: LNS2009 EQ ID: EP07R04 | Currency in US dollars | TRACES MII Version 3.0

Contingency	Contingency	Running %
SIOH	SIOH	Running %

Description	Contractor	DirectCost	CostToPrime	ContractCost
Marsh Lake MII Summary		**7,083,978.53**	**7,432,452.31**	**9,175,672.54**
01 Lands and Damages	**No Markup Contractor**	**10,000.00**	**10,000.00**	**10,000.00**
Real Estate Adminsitration Costs	No Markup Contractor	10,000.00	10,000.00	10,000.00
Construction Costs for Alternative Measures	**Prime**	**7,073,978.53**	**7,422,452.31**	**9,165,672.54**
02 Relocations	**Prime**	**2,000,000.00**	**2,000,000.00**	**2,000,000.00**
02 Two Lane Bridge (Alternative measure 2)	**Prime**	**2,000,000.00**	**2,000,000.00**	**2,000,000.00**
Two Lane Bridge Revised February 2011	No Markup Contractor	2,000,000.00	2,000,000.00	2,000,000.00
03 Reservoirs	**Prime**	**1,999,814.28**	**2,237,957.85**	**2,889,424.04**
03 Fishway (Alternative measure 3)	**Prime**	**393,729.69**	**393,729.69**	**538,257.51**
Earthwork to Prepare Fishway for Scour Protection Placement	**Prime**	**84,598.76**	**84,598.76**	**115,652.74**
Excavation and Reuse of Channel Material	**Prime**	**53,757.47**	**53,757.47**	**73,490.43**
Excavate and load, bank measure, wet material, 2 C.Y. bucket, hydraulic excavator	Prime	38,341.17	38,341.17	52,415.21
Fill, from stockpile, 130 H.P., 2-1/2 C.Y., 300' haul, spread fill, with front-end loader, excludes compaction	Prime	15,416.30	15,416.30	21,075.22
Excavate and Remove Excess Channel Material	**Prime**	**30,841.28**	**30,841.28**	**42,162.31**
Excavate and load, bank measure, wet material, 2 C.Y. bucket, hydraulic excavator	Prime	6,623.98	6,623.98	9,055.47
Hauling Excess Channel Material From Fishway	Prime	17,424.53	17,424.53	23,820.61
Fill, borrow, spread, by dozer	Prime	6,792.78	6,792.78	9,286.23
Rockfill Boulders	**Prime**	**60,018.45**	**60,018.45**	**82,049.65**
Place Boulders for Fishway	Prime	15,054.14	15,054.14	20,580.12
Hauling Rockfill Boulders for Fishway	Prime	2,897.99	2,897.99	3,961.76
Excavate and load, bank measure, blasted rock, 5 C.Y. bucket, wheeled loader	Prime	3,518.65	3,518.65	4,810.26
Rockfill for Fishway	Prime	38,547.68	38,547.68	52,697.51
Riprap for Channel Bed and Scour Hole	**Prime**	**190,569.95**	**190,569.95**	**260,523.16**
Hauling Rockfill for Fishway	Prime	11,897.00	11,897.00	16,264.07
Excavate and load, bank measure, blasted rock, 5 C.Y. bucket, wheeled loader	Prime	14,444.99	14,444.99	19,747.37
R20 to R270 Riprap	Prime	133,327.35	133,327.35	182,268.32
Place Riprap for Fishway Scour Hole	Prime	30,900.60	30,900.60	42,243.40
Bedding for Channel Bed and Scour Hole	**Prime**	**51,407.50**	**51,407.50**	**70,277.84**
Hauling Rockfill for Fishway	Prime	3,355.56	3,355.56	4,587.30
Excavate and load, bank measure, blasted rock, 5 C.Y. bucket, wheeled loader	Prime	4,074.23	4,074.23	5,569.77
Place Riprap for Fishway Scour Hole	Prime	8,715.55	8,715.55	11,914.81
B3 Bedding	Prime	35,262.15	35,262.15	48,205.96
Construct and Remove Access Road in Centerline of Fishway Channel	**Prime**	**7,135.04**	**7,135.04**	**9,754.12**
Fill, borrow, spread, by dozer	Prime	2,574.19	2,574.19	3,519.10
Excavate and load, bank measure, wet rock, 3-1/2 C.Y. bucket, hydraulic excavator	Prime	4,560.85	4,560.85	6,235.02
03 Modify Existing Spillway Southeast of Marsh Lake (Alternative measure 3)	**Prime**	**42,764.25**	**54,759.00**	**66,294.67**
Concrete Demolition	**Structures Contractor**	**21,741.21**	**27,839.31**	**33,704.00**
Selective site demolition, hydodemolition, concrete pavement, 6000 PSI, 6" depth	Structures Contractor	11,513.27	14,742.57	17,848.28
Selective concrete demolition, maximum reinforcing, break up into small pieces, excl shoring, bracing, saw or torch cutting, loading, hauling, dumping	Structures Contractor	8,685.82	11,122.06	13,465.07
Hauling Concrete Demolition Material To Disposal Site.	Structures Contractor	1,542.13	1,974.67	2,390.66
One foot concrete raise on spillway crest	**Structures Contractor**	**21,023.04**	**26,919.69**	**32,590.66**
Structural concrete, ready mix, normal weight, 4500 psi, includes local aggregate, sand, portland cement and water, delivered, excludes all additives and treatments	Structures Contractor	1,218.89	1,560.77	1,889.57
Reinforcing steel, in place, slab on grade, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories	Structures Contractor	895.88	1,147.16	1,388.82
Structural concrete, placing, slab on grade, pumped, over 6" thick, includes vibrating, excludes material	Structures Contractor	454.25	581.66	704.20
Concrete finishing, floors, manual screed, bull float, manual float, manual steel trowel	Structures Contractor	594.33	761.03	921.35
Concrete surface treatment, curing, sprayed membrane compound	Structures Contractor	67.84	86.87	105.17
Concrete impact drilling, for anchors, up to 4" D, 1" dia, in concrete or brick walls and floors, incl bit & layout, excl anchor	Structures Contractor	3,222.07	4,125.81	4,994.97
Chemical anchor, 3/4" dia x 9-1/2" L, in concrete, brick or stone, incl layout, drilling, threaded rod & epoxy cartridge	Structures Contractor	12,881.34	16,494.37	19,969.11
C.I.P. concrete forms, slab on grade, curb, wood, 6" to 12" high, 1 use, includes erecting, bracing, stripping and cleaning	Structures Contractor	1,688.44	2,162.02	2,617.48

Currency in US dollars

Description	Contractor	DirectCost	CostToPrime	ContractCost
03 Pedestrian Bridge over Existing Spillway (Alternative measure 3)	**Structures Contractor**	**186,973.88**	**239,417.32**	**289,853.55**
Pedestrian Bridge	Structures Contractor	130,000.00	166,463.10	201,530.62
Concrete Deck	**Structures Contractor**	**15,660.92**	**20,053.58**	**24,278.12**
Structural concrete, ready mix, normal weight, 4500 psi, includes local aggregate, sand, portland cement and water, delivered, excludes all additives and treatments	Structures Contractor	2,553.87	3,270.19	3,959.10
C.I.P. concrete forms, elevated slab, flat plate, plywood, to 15' high, 2 use, includes shoring, erecting, bracing, stripping and cleaning	Structures Contractor	8,475.17	10,852.33	13,138.51
Reinforcing steel, in place, elevated slabs, #4 to #7, A615, grade 60, incl labor for accessories, excl material for accessories	Structures Contractor	1,767.84	2,263.69	2,740.57
Structural concrete, placing, elevated slab, pumped, 6" to 10" thick, includes vibrating, excludes material	Structures Contractor	475.94	609.44	737.83
Concrete finishing, floors, manual screed, bull float, manual float, manual steel trowel	Structures Contractor	1,252.87	1,604.28	1,942.24
Concrete surface treatment, curing, sprayed membrane compound	Structures Contractor	121.92	156.12	189.01
C.I.P. concrete forms, slab on grade, edge, wood, to 6" high, 4 use, includes erecting, bracing, stripping and cleaning	Structures Contractor	1,013.31	1,297.53	1,570.87
Concrete Footings	**Structures Contractor**	**41,312.96**	**52,900.64**	**64,044.82**
Earthwork	**Structures Contractor**	**2,279.89**	**2,919.36**	**3,534.36**
Excavating, trench or continuous footing, common earth, 1 1/2 C.Y. excavator, 6' to 10' deep, excludes sheeting or dewatering	Structures Contractor	1,007.68	1,290.32	1,562.14
Compaction, 3 passes, 24" wide, 6" lifts, walk behind, vibrating roller	Structures Contractor	624.41	799.55	967.98
Excavating, trench or continuous footing, common earth, 1 1/2 C.Y. excavator, 6' to 10' deep, excludes sheeting or dewatering	Structures Contractor	647.79	829.49	1,004.23
Concrete Work	**Structures Contractor**	**39,033.07**	**49,981.28**	**60,510.45**
Structural concrete, ready mix, normal weight, 4500 psi, includes local aggregate, sand, portland cement and water, delivered, excludes all additives and treatments	Structures Contractor	5,606.91	7,179.56	8,692.02
Structural concrete, placing, walls, pumped, 15" thick, includes vibrating, excludes material	Structures Contractor	1,393.22	1,784.00	2,159.82
Reinforcing steel, in place, walls, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories	Structures Contractor	29,905.66	38,293.76	46,360.82
C.I.P. concrete forms, slab on grade, curb, wood, 6" to 12" high, 2 use, includes erecting, bracing, stripping and cleaning	Structures Contractor	637.39	816.17	988.10
C.I.P. concrete forms, wall, job built, plywood, 8 to 16' high, 2 use, includes erecting, bracing, stripping and cleaning	Structures Contractor	1,339.14	1,714.76	2,075.99
Concrete surface treatment, curing, sprayed membrane compound	Structures Contractor	150.75	193.04	233.70
03 Drawdown Structure (Alternative measure 4)	**Prime**	**1,179,590.83**	**1,351,303.52**	**1,724,719.00**
Dewatering / Cofferdams	**Prime**	**94,482.64**	**115,810.83**	**143,092.42**
Cofferdams	**Structures Contractor**	**76,040.29**	**97,368.49**	**117,880.37**
Sheet piling, steel, 22 psf, 15' excavation, drive, extract and salvage, excludes wales	Structures Contractor	76,040.29	97,368.49	117,880.37
Dewatering	**Prime**	**18,442.35**	**18,442.35**	**25,212.05**
Dewatering, pumping, 8 hr., attended 2 hours per day, 4" discharge pump used for 8 hours, includes 20 L.F. of suction hose and 100 L.F. of discharge hose	Prime	13,258.35	13,258.35	18,125.14
Generator set, portable, gasoline powered, 120/240 V, 2.5 kW	Prime	5,184.00	5,184.00	7,086.91
Earthwork for Drawdown Structure	**Prime**	**11,035.24**	**11,035.24**	**15,085.98**
Excavating, trench or continuous footing, common earth, 2 1/2 C.Y. excavator, 6' to 10' deep, excludes sheeting or dewatering	Prime	3,365.61	3,365.61	4,601.04
Compaction, 2 passes, 24" wide, 6" lifts, walk behind, vibrating roller	Prime	2,957.77	2,957.77	4,043.49
Excavating, trench or continuous footing, common earth, 2 1/2 C.Y. excavator, 6' to 10' deep, excludes sheeting or dewatering	Prime	4,711.85	4,711.85	6,441.45
Backfill, structural, 6" lifts, backfill around foundation, with hydraulic excavator	Prime	0.00	0.00	0.00
Concrete Structure	**Structures Contractor**	**391,945.77**	**501,880.83**	**607,608.27**
Railing, pipe, aluminum, satin finish, 2 rails, 1-1/4" dia, shop fabricated	Structures Contractor	17,629.02	22,573.70	27,329.13
Base Slabs	**Structures Contractor**	**170,406.35**	**218,202.84**	**264,169.98**
Structural concrete, ready mix, normal weight, 4500 psi, includes local aggregate, sand, portland cement and water, delivered, excludes all additives and treatments	Structures Contractor	83,494.14	106,913.02	129,435.58
C.I.P. concrete forms, slab on grade, depressed, edge, wood, 12" to 24" high, 4 use, includes erecting, bracing, stripping and cleaning	Structures Contractor	5,603.27	7,174.90	8,686.38
Reinforcing steel, in place, slab on grade, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories	Structures Contractor	57,422.62	73,528.83	89,018.59
Structural concrete, placing, slab on grade, pumped, over 6" thick, includes vibrating, excludes material	Structures Contractor	13,457.41	17,232.01	20,862.15
Concrete finishing, floors, manual screed, bull float, manual float, manual steel trowel	Structures Contractor	9,504.04	12,169.79	14,733.51
Concrete surface treatment, curing, sprayed membrane compound	Structures Contractor	924.87	1,184.28	1,433.77
Walls	**Structures Contractor**	**173,131.21**	**221,691.98**	**268,394.16**
Structural concrete, ready mix, normal weight, 4500 psi, includes local aggregate, sand, portland cement and water, delivered, excludes all additives and treatments	Structures Contractor	43,880.13	56,187.87	68,024.54
Reinforcing steel, in place, walls, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories	Structures Contractor	25,914.72	33,183.42	40,173.93
Structural concrete, placing, walls, pumped, 15" thick, includes vibrating, excludes material	Structures Contractor	10,903.45	13,961.70	16,902.91
Concrete surface treatment, curing, sprayed membrane compound	Structures Contractor	1,179.08	1,509.79	1,827.84
Concrete finishing, floors, manual screed, bull float	Structures Contractor	950.93	1,217.65	1,474.16

Currency in US dollars

Description	Contractor	DirectCost	CostToPrime	ContractCost
C.I.P. concrete forms, wall, job built, plywood, 8 to 16' high, 2 use, includes erecting, bracing, stripping and cleaning	Structures Contractor	90,302.91	115,631.55	139,990.78
Elevated Slab for Walkway	**Structures Contractor**	**30,779.19**	**39,412.30**	**47,715.00**
C.I.P. concrete forms, elevated slab, flat plate, plywood, to 15' high, 3 use, includes shoring, erecting, bracing, stripping and cleaning	Structures Contractor	11,489.07	14,711.59	17,810.77
C.I.P. concrete forms, slab on grade, depressed, edge, wood, 12" to 24" high, 4 use, includes erecting, bracing, stripping and cleaning	Structures Contractor	2,465.44	3,156.96	3,822.01
Structural concrete, ready mix, normal weight, 4500 psi, includes local aggregate, sand, portland cement and water, delivered, excludes all additives and treatments	Structures Contractor	8,532.25	10,925.42	13,226.99
Reinforcing steel, in place, slab on grade, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories	Structures Contractor	4,743.52	6,074.01	7,353.58
Concrete finishing, floors, manual screed, bull float, manual float, manual steel trowel	Structures Contractor	1,946.12	2,491.98	3,016.95
Concrete surface treatment, curing, sprayed membrane compound	Structures Contractor	189.38	242.50	293.59
Structural concrete, placing, elevated slab, pumped, over 10" thick, includes vibrating, excludes material	Structures Contractor	1,413.41	1,809.85	2,191.12
Sheetpile	**Structures Contractor**	**36,221.27**	**46,380.81**	**56,151.50**
Sheet piling, 15' excavation, left in place, excludes wales	Structures Contractor	36,221.27	46,380.81	56,151.50
Stoplogs	**Structures Contractor**	**107,991.00**	**138,280.90**	**167,411.49**
Stoplog Frames and Stoplogs for Drawdown Structure	Structures Contractor	107,991.00	138,280.90	167,411.49
Scour Protection Downstream of Structure	**Prime**	**537,914.92**	**537,914.92**	**735,369.34**
Construct and Remove Access Road in Centerline of Channel	**Prime**	**17,051.80**	**17,051.80**	**23,311.07**
Fill, borrow, spread, by dozer	Prime	6,531.52	6,531.52	8,929.06
Excavate and load, bank measure, wet rock, 3-1/2 C.Y. bucket, hydraulic excavator	Prime	10,520.28	10,520.28	14,382.00
Channel Excavation	**Prime**	**92,757.77**	**92,757.77**	**126,806.71**
Excavate and load, bank measure, wet material, 2 C.Y. bucket, hydraulic excavator	Prime	21,713.03	21,713.03	29,683.31
Hauling, excavated or borrow material, loose cubic yards, 20 mile round trip, 0.4 loads/hour, 16.5 C.Y. dump trailer, highway haulers, excludes loading	Prime	48,778.42	48,778.42	66,683.70
Fill, borrow, spread, by dozer	Prime	22,266.32	22,266.32	30,439.70
R270 Riprap	**Prime**	**335,619.87**	**335,619.87**	**458,817.10**
R20 to R270 Riprap	Prime	214,417.73	214,417.73	293,124.84
Hauling, excavated or borrow material, loose cubic yards, 2 mile round trip, 3.3 loads/hour, 22 C.Y. rear/bottom dump, off highway haulers	Prime	18,460.41	18,460.41	25,236.75
Excavate and load, bank measure, blasted rock, 5 C.Y. bucket, wheeled loader	Prime	23,230.51	23,230.51	31,757.83
Place Riprap for Scour Protection in Channel D/S of Drawdown Structure	Prime	79,511.21	79,511.21	108,697.69
B3 Bedding	**Prime**	**92,485.48**	**92,485.48**	**126,434.47**
B3 Bedding	Prime	57,701.70	57,701.70	78,882.48
Hauling, excavated or borrow material, loose cubic yards, 2 mile round trip, 3.3 loads/hour, 22 C.Y. rear/bottom dump, off highway haulers	Prime	5,297.95	5,297.95	7,242.69
Excavate and load, bank measure, blasted rock, 5 C.Y. bucket, wheeled loader	Prime	6,666.92	6,666.92	9,114.17
Place Riprap for Scour Protection in Channel D/S of Drawdown Structure	Prime	22,818.91	22,818.91	31,195.13
03 Embankments on Sides of Fishway and Drawdown Structure Downstream Channel (Alternative measures 3 and 4)	**Prime**	**196,755.62**	**198,748.32**	**270,299.31**
Stripping	**Prime**	**2,045.72**	**2,045.72**	**2,796.65**
Loam or topsoil, remove and stockpile on site, 200 H.P. dozer, 6" deep, 200' haul	Prime	2,045.72	2,045.72	2,796.65
Impervious Fill	**Prime**	**183,817.12**	**183,817.12**	**251,291.55**
Placing Impervious Fill for Downstream Embankments for Fishway and Drawdown Structure	Prime	54,314.43	54,314.43	74,251.82
Hauling, excavated or borrow material, loose cubic yards, 20 mile round trip, 0.4 loads/hour, 16.5 C.Y. dump trailer, highway haulers, excludes loading	Prime	129,502.69	129,502.69	177,039.73
Topsoil and Seeding	**Prime**	**10,892.79**	**12,885.48**	**16,211.11**
Topsoil	**Prime**	**3,907.28**	**3,907.28**	**5,341.54**
Placing Topsoil	Prime	3,907.28	3,907.28	5,341.54
Seeding	**Seeding Contractor**	**6,985.50**	**8,978.20**	**10,869.56**
Seeding, athletic field mix, 450 lb. per acre, mechanical seeding	Seeding Contractor	1,047.20	1,345.93	1,629.46
Seeding, apply fertilizer, nitrogen, 1 lb. per M.S.F., sprayed from truck	Seeding Contractor	427.73	549.74	665.55
Soil preparation, mulching, oat straw, 1" deep, power mulcher, small	Seeding Contractor	3,847.11	4,944.54	5,986.17
Watering, water, by truck	Seeding Contractor	1,663.47	2,137.99	2,588.38
10 Breakwater & Seawalls	**Prime**	**2,188,928.97**	**2,188,928.97**	**2,992,427.25**
10 Breakwater A (Alternative measure number 7)	**Prime**	**865,790.23**	**865,790.23**	**1,183,599.06**
Rockfill Placement for Breakers	Prime	129,446.17	129,446.17	176,962.45
Rockfill for Breaker Rock	Prime	632,450.25	632,450.25	864,606.11

Currency in US dollars

Description	Contractor	DirectCost	CostToPrime	ContractCost
Hauling Breakwater Rock on Ice: Site A	Prime	73,597.68	73,597.68	100,613.46
Breakwaters Ice Road Maintenance	Prime	15,788.12	15,788.12	21,583.53
Breakwaters Ice Road Constructuion	Prime	14,508.01	14,508.01	19,833.51
10 Breakwater B(Alternative Measure number 7)	**Prime**	**596,600.99**	**596,600.99**	**815,597.52**
Rockfill Placement for Breakers	Prime	88,513.19	88,513.19	121,004.06
Rockfill for Breaker Rock	Prime	432,459.23	432,459.23	591,203.64
Hauling Breakwater Rock on Ice: Site B	Prime	50,324.90	50,324.90	68,797.85
Breakwaters Ice Road Maintenance	Prime	10,795.66	10,795.66	14,758.47
Breakwaters Ice Road Constructuion	Prime	14,508.01	14,508.01	19,833.51
10 Breakwater C (Alternative Measure number 7)	**Prime**	**726,537.75**	**726,537.75**	**993,230.66**
Rockfill Placement for Breakers	Prime	109,854.32	109,854.32	150,178.95
Rockfill for Breaker Rock	Prime	536,728.05	536,728.05	733,746.81
Hauling Breakwater Rock on Ice: Site C	Prime	52,048.81	52,048.81	71,154.56
Breakwaters Ice Road Maintenance	Prime	13,398.57	13,398.57	18,316.83
Breakwaters Ice Road Constructuion	Prime	14,508.01	14,508.01	19,833.51
11 Levees & Floodwalls	**Prime**	**668,288.34**	**714,986.20**	**944,134.44**
11 Fish Pond Levee Breach (Alternative measure 6)	**Prime**	**4,173.98**	**4,371.82**	**5,837.18**
Excavation	**Prime**	**2,836.92**	**2,836.92**	**3,878.27**
Excavate and load, bank measure, medium material, 3-1/2 C.Y. bucket, hydraulic excavator	Prime	1,068.04	1,068.04	1,460.08
Grading Fishway Excavated Surface	Prime	181.14	181.14	247.63
Hauling, excavated or borrow material, loose cubic yards, 1 mile round trip, 3.9 loads/hour, 22 C.Y. rear/bottom dump, off highway haulers	Prime	1,587.74	1,587.74	2,170.56
Topsoil and Seeding	**Prime**	**1,337.07**	**1,534.91**	**1,958.91**
Topsoil	**Prime**	**643.53**	**643.53**	**879.76**
Placing Topsoil	Prime	465.15	465.15	635.90
Loam or topsoil, remove and stockpile on site, 200 H.P. dozer, 6" deep, 200' haul	Prime	178.38	178.38	243.86
Seeding	**Seeding Contractor**	**693.53**	**891.37**	**1,079.15**
Seeding, athletic field mix, 450 lb. per acre, mechanical seeding	Seeding Contractor	140.00	179.94	217.84
Seeding, apply fertilizer, nitrogen, 1 lb. per M.S.F., sprayed from truck	Seeding Contractor	130.13	167.25	202.49
Soil preparation, mulching, oat straw, 1" deep, power mulcher, small	Seeding Contractor	290.58	373.48	452.15
Watering, water, by truck	Seeding Contractor	132.82	170.70	206.66
11 Diversion Dike A (Alternative measure 2)	**Prime**	**141,001.22**	**143,718.53**	**194,558.89**
Clearing and Grubbing	**Prime**	**17,398.95**	**17,398.95**	**23,785.64**
Clear and grub, cut and chip, heavy trees, to 16" diameter	Prime	7,487.73	7,487.73	10,236.27
Clear and grub, heavy stumps, to 16" diameter, includes loading on site	Prime	2,807.20	2,807.20	3,837.64
Hauling Clearing and Grubbing Material	Prime	7,104.02	7,104.02	9,711.72
Stripping	**Prime**	**2,713.88**	**2,713.88**	**3,710.07**
Loam or topsoil, remove and stockpile on site, 200 H.P. dozer, 6" deep, 200' haul	Prime	2,713.88	2,713.88	3,710.07
Impervious Fill	**Prime**	**106,153.01**	**106,153.01**	**145,118.98**
Placing Impervious Fill	Prime	51,778.98	51,778.98	70,785.68
Hauling, excavated or borrow material, loose cubic yards, 1 mile round trip, 3.9 loads/hour, 22 C.Y. rear/bottom dump, off highway haulers	Prime	54,374.03	54,374.03	74,333.30
Topsoil and Seeding	**Prime**	**14,735.40**	**17,452.70**	**21,944.19**
Topsoil	**Prime**	**5,209.71**	**5,209.71**	**7,122.06**
Placing Topsoil	Prime	5,209.71	5,209.71	7,122.06
Seeding	**Seeding Contractor**	**9,525.69**	**12,242.99**	**14,822.13**
Seeding, athletic field mix, 450 lb. per acre, mechanical seeding	Seeding Contractor	1,428.00	1,835.35	2,221.99
Seeding, apply fertilizer, nitrogen, 1 lb. per M.S.F., sprayed from truck	Seeding Contractor	583.26	749.65	907.57
Soil preparation, mulching, oat straw, 1" deep, power mulcher, small	Seeding Contractor	5,246.06	6,742.56	8,162.96
Watering, water, by truck	Seeding Contractor	2,268.36	2,915.44	3,529.61
11 Diversion Dike B (Alternative measure 2)	**Prime**	**46,430.91**	**47,349.62**	**64,082.99**

Currency in US dollars

Description	Contractor	DirectCost	CostToPrime	ContractCost
Clearing and Grubbing	**Prime**	**13,919.16**	**13,919.16**	**19,028.51**
Clear and grub, cut and chip, heavy trees, to 16" diameter	Prime	5,990.18	5,990.18	8,189.02
Clear and grub, heavy stumps, to 16" diameter, includes loading on site	Prime	2,245.76	2,245.76	3,070.11
Hauling Clearing and Grubbing Material	Prime	5,683.22	5,683.22	7,769.38
Stripping	**Prime**	**1,105.35**	**1,105.35**	**1,511.09**
Loam or topsoil, remove and stockpile on site, 200 H.P. dozer, 6" deep, 200' haul	Prime	1,105.35	1,105.35	1,511.09
Impervious Fill	**Prime**	**13,715.30**	**13,715.30**	**18,749.83**
Placing Impervious Fill	Prime	5,838.51	5,838.51	7,981.67
Hauling, excavated or borrow material, loose cubic yards, 1 mile round trip, 3.9 loads/hour, 22 C.Y. rear/bottom dump, off highway haulers	Prime	7,876.79	7,876.79	10,768.15
Topsoil and Seeding	**Prime**	**4,964.91**	**5,883.62**	**7,395.91**
Topsoil	**Prime**	**1,744.32**	**1,744.32**	**2,384.62**
Placing Topsoil	Prime	1,744.32	1,744.32	2,384.62
Seeding	**Seeding Contractor**	**3,220.59**	**4,139.30**	**5,011.29**
Seeding, athletic field mix, 450 lb. per acre, mechanical seeding	Seeding Contractor	482.80	620.52	751.25
Seeding, apply fertilizer, nitrogen, 1 lb. per M.S.F., sprayed from truck	Seeding Contractor	197.20	253.45	306.84
Soil preparation, mulching, oat straw, 1" deep, power mulcher, small	Seeding Contractor	1,773.67	2,279.63	2,759.86
Watering, water, by truck	Seeding Contractor	766.92	985.70	1,193.35
Riprap	**Prime**	**8,336.79**	**8,336.79**	**11,397.00**
R20 Riprap	Prime	4,957.04	4,957.04	6,776.64
Hauling, excavated or borrow material, loose cubic yards, 2 mile round trip, 3.3 loads/hour, 22 C.Y. rear/bottom dump, off highway haulers	Prime	512.14	512.14	700.13
Excavate and load, bank measure, blasted rock, 3 C.Y. bucket, wheeled loader	Prime	569.87	569.87	779.06
Place Riprap and Bedding for Small Quantities	Prime	2,297.74	2,297.74	3,141.18
Bedding	**Prime**	**4,389.41**	**4,389.41**	**6,000.64**
B1 Bedding	Prime	2,564.52	2,564.52	3,505.89
Hauling, excavated or borrow material, loose cubic yards, 2 mile round trip, 3.3 loads/hour, 22 C.Y. rear/bottom dump, off highway haulers	Prime	263.72	263.72	360.52
Excavate and load, bank measure, blasted rock, 3 C.Y. bucket, wheeled loader	Prime	293.45	293.45	401.17
Place Riprap and Bedding for Small Quantities	Prime	1,267.72	1,267.72	1,733.06
11 Road Raise (Alternative measure 2)	**Prime**	**239,368.68**	**239,873.33**	**327,568.89**
Stripping	**Prime**	**3,184.06**	**3,184.06**	**4,352.85**
Loam or topsoil, remove and stockpile on site, 200 H.P. dozer, 6" deep, 200' haul	Prime	3,184.06	3,184.06	4,352.85
Impervious Fill	**Prime**	**83,024.43**	**83,024.43**	**113,500.52**
Placing Impervious Fill	Prime	40,497.39	40,497.39	55,362.92
Hauling, excavated or borrow material, loose cubic yards, 1 mile round trip, 3.9 loads/hour, 22 C.Y. rear/bottom dump, off highway haulers	Prime	42,527.04	42,527.04	58,137.59
Topsoil and Seeding	**Prime**	**2,745.88**	**3,250.52**	**4,088.07**
Topsoil	**Prime**	**976.82**	**976.82**	**1,335.39**
Placing Topsoil	Prime	976.82	976.82	1,335.39
Seeding	**Seeding Contractor**	**1,769.06**	**2,273.70**	**2,752.68**
Seeding, athletic field mix, 450 lb. per acre, mechanical seeding	Seeding Contractor	265.20	340.85	412.66
Seeding, apply fertilizer, nitrogen, 1 lb. per M.S.F., sprayed from truck	Seeding Contractor	108.32	139.22	168.55
Soil preparation, mulching, oat straw, 1" deep, power mulcher, small	Seeding Contractor	974.27	1,252.19	1,515.98
Watering, water, by truck	Seeding Contractor	421.27	541.44	655.50
Roadway Aggregate	**Prime**	**38,674.50**	**38,674.50**	**52,870.89**
Class 5 Aggregate for Road Raise	Prime	38,674.50	38,674.50	52,870.89
Riprap	**Prime**	**73,881.17**	**73,881.17**	**101,001.01**
R20 Riprap	Prime	43,929.65	43,929.65	60,055.07
Hauling, excavated or borrow material, loose cubic yards, 2 mile round trip, 3.3 loads/hour, 22 C.Y. rear/bottom dump, off highway haulers	Prime	4,538.58	4,538.58	6,204.57
Excavate and load, bank measure, blasted rock, 3 C.Y. bucket, wheeled loader	Prime	5,050.24	5,050.24	6,904.04
Place Riprap and Bedding for Small Quantities	Prime	20,362.71	20,362.71	27,837.32
Bedding	**Prime**	**37,858.64**	**37,858.64**	**51,755.56**

Currency in US dollars

Description	Contractor	DirectCost	CostToPrime	ContractCost
B1 Bedding	Prime	22,118.99	22,118.99	30,238.28
Hauling, excavated or borrow material, loose cubic yards, 2 mile round trip, 3.3 loads/hour, 22 C.Y. rear/bottom dump, off highway haulers	Prime	2,274.59	2,274.59	3,109.53
Excavate and load, bank measure, blasted rock, 3 C.Y. bucket, wheeled loader	Prime	2,531.01	2,531.01	3,460.08
Place Riprap and Bedding for Small Quantities	Prime	10,934.06	10,934.06	14,947.67
11 Louisburg Road Culverts (Alternative Measure number 5)	**Prime**	**237,313.53**	**279,672.89**	**352,086.50**
Dewatering	**Prime**	**26,733.54**	**26,733.54**	**36,546.72**
Cofferdams	**Prime**	**8,291.19**	**8,291.19**	**11,334.67**
Placing Impervious Fill	Prime	2,326.10	2,326.10	3,179.95
Hauling, excavated or borrow material, loose cubic yards, 20 mile round trip, 0.5 loads/hour, 20 C.Y. dump trailer, highway haulers, excludes loading	Prime	5,965.09	5,965.09	8,154.72
Sump Pump	**Prime**	**18,442.35**	**18,442.35**	**25,212.05**
Dewatering, pumping, 8 hr., attended 2 hours per day, 4" discharge pump used for 8 hours, includes 20 L.F. of suction hose and 100 L.F. of discharge hose	Prime	13,258.35	13,258.35	18,125.14
Generator set, portable, gasoline powered, 120/240 V, 2.5 kW	Prime	5,184.00	5,184.00	7,086.91
Removal of Existing Piping	**Prime**	**20,538.22**	**20,538.22**	**28,077.26**
Topsoil stripping and stockpiling, topsoil, sandy loam, adverse conditions, 200 H.P. dozer	Prime	356.76	356.76	487.72
Excavating, trench or continuous footing, common earth, 2 1/2 C.Y. excavator, 6' to 10' deep, excludes sheeting or dewatering	Prime	3,737.26	3,737.26	5,109.11
Selective demolition, water & sewer piping & fittings, concrete pipe, 60"-84", diameter, excludes excavation	Prime	15,411.78	15,411.78	21,069.04
Load and Haul 60" RCP from Site	Prime	1,032.41	1,032.41	1,411.38
Concrete Structures	**Structures Contractor**	**123,021.63**	**157,527.40**	**190,712.51**
Base Slabs	**Structures Contractor**	**33,580.28**	**42,999.06**	**52,057.34**
Structural concrete, ready mix, normal weight, 4500 psi, includes local aggregate, sand, portland cement and water, delivered, excludes all additives and treatments	Structures Contractor	14,017.26	17,948.90	21,730.06
C.I.P. concrete forms, slab on grade, depressed, edge, wood, 12" to 24" high, 4 use, includes erecting, bracing, stripping and cleaning	Structures Contractor	4,127.74	5,285.51	6,398.97
Reinforcing steel, in place, slab on grade, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories	Structures Contractor	10,357.69	13,262.87	16,056.86
Structural concrete, placing, slab on grade, pumped, over 6" thick, includes vibrating, excludes material	Structures Contractor	2,259.27	2,892.97	3,502.40
Concrete finishing, floors, manual screed, bull float, manual float, manual steel trowel	Structures Contractor	2,568.38	3,288.77	3,981.59
Concrete surface treatment, curing, sprayed membrane compound	Structures Contractor	249.94	320.04	387.46
Walls	**Structures Contractor**	**63,327.55**	**81,090.01**	**98,172.62**
Structural concrete, ready mix, normal weight, 4500 psi, includes local aggregate, sand, portland cement and water, delivered, excludes all additives and treatments	Structures Contractor	16,698.63	21,382.60	25,887.12
C.I.P. concrete forms, wall, job built, plywood, to 8' high, 4 use, includes erecting, bracing, stripping and cleaning	Structures Contractor	29,668.61	37,990.22	45,993.34
Reinforcing steel, in place, walls, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories	Structures Contractor	11,380.77	14,572.90	17,642.87
Structural concrete, placing, walls, pumped, 15" thick, includes vibrating, excludes material	Structures Contractor	4,149.37	5,313.20	6,432.50
Concrete surface treatment, curing, sprayed membrane compound	Structures Contractor	604.52	774.08	937.15
Concrete finishing, floors, manual screed, bull float	Structures Contractor	825.46	1,056.99	1,279.65
Top Slabs	**Structures Contractor**	**26,113.80**	**33,438.34**	**40,482.54**
C.I.P. concrete forms, elevated slab, flat plate, plywood, to 15' high, 3 use, includes shoring, erecting, bracing, stripping and cleaning	Structures Contractor	7,766.22	9,944.53	12,039.47
C.I.P. concrete forms, slab on grade, depressed, edge, wood, 12" to 24" high, 4 use, includes erecting, bracing, stripping and cleaning	Structures Contractor	653.71	837.07	1,013.41
Structural concrete, ready mix, normal weight, 4500 psi, includes local aggregate, sand, portland cement and water, delivered, excludes all additives and treatments	Structures Contractor	8,532.25	10,925.42	13,226.99
Reinforcing steel, in place, slab on grade, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories	Structures Contractor	6,304.68	8,073.05	9,773.74
Concrete finishing, floors, manual screed, bull float, manual float, manual steel trowel	Structures Contractor	1,315.51	1,684.49	2,039.35
Concrete surface treatment, curing, sprayed membrane compound	Structures Contractor	128.02	163.92	198.46
Structural concrete, placing, elevated slab, pumped, over 10" thick, includes vibrating, excludes material	Structures Contractor	1,413.41	1,809.85	2,191.12
Stoplog Structures	**Structures Contractor**	**28,000.00**	**35,853.59**	**43,406.60**
Stoplogs and Frames	Structures Contractor	28,000.00	35,853.59	43,406.60
Backfill and Restoration of Roadbed	**Prime**	**5,114.76**	**5,114.76**	**6,992.25**
Backfill, trench, 3.25 CY wheel loader	Prime	2,117.18	2,117.18	2,894.34
Compaction, of backfill, structural, 6" lifts, self propelled roller	Prime	1,355.39	1,355.39	1,852.92
Compaction, 2 passes, 24" wide, 6" lifts, walk behind, vibrating roller	Prime	1,642.19	1,642.19	2,245.00
Scour Protection	**Prime**	**19,322.29**	**19,322.29**	**26,414.99**
Earthwork for Preformed Scour Hole	**Prime**	**3,460.84**	**3,460.84**	**4,731.22**
Backfill, dumped gravel or fill, 6" layers, spread, dozer	Prime	927.68	927.68	1,268.21

Currency in US dollars

Description	Contractor	DirectCost	CostToPrime	ContractCost
Excavate and load, bank measure, wet material, 2 C.Y. bucket, hydraulic excavator	Prime	884.50	884.50	1,209.17
Hauling, excavated or borrow material, loose cubic yards, 10 mile round trip, 0.6 load/hour, 16.5 C.Y. dump trailer, highway haulers, excludes loading	Prime	1,648.66	1,648.66	2,253.84
R270 Riprap	**Prime**	**12,508.24**	**12,508.24**	**17,099.69**
R20 to R270 Riprap	Prime	8,546.63	8,546.63	11,683.87
Place Riprap and Bedding for Small Quantities	Prime	3,961.62	3,961.62	5,415.82
B3 Bedding	**Prime**	**3,353.21**	**3,353.21**	**4,584.08**
B3 Bedding	Prime	2,243.96	2,243.96	3,067.65
Place Riprap and Bedding for Small Quantities	Prime	1,109.25	1,109.25	1,516.43
Guardrail	**Prime**	**14,583.10**	**14,583.10**	**19,936.18**
Guide/Guard rail, corrugated steel, galvanized steel posts, install metal guide/guard rail, steel posts 12' - 6" O.C., W6x8 posts	Prime	9,547.57	9,547.57	13,052.23
Vehicle guide rails, guide/guard rai, steel box beam, end assembly	Prime	5,035.54	5,035.54	6,883.95
14 Recreation Features	**Recreation Contractor**	**216,946.94**	**280,579.29**	**339,686.81**
Day Use Facility	**Recreation Contractor**	**87,587.46**	**113,277.59**	**137,140.93**
Picnic Tables	**Recreation Contractor**	**5,516.36**	**7,134.35**	**8,637.29**
Site seating, picnic tables, recycled plastic, various colors, 8' long	Recreation Contractor	3,760.78	4,863.85	5,888.47
Sidewalks, driveways, and patios, sidewalk, concrete, cast-in-place with 6 x 6 - W1.4 x W1.4 mesh, broomed finish, 3000 psi, 4" thick, excludes base	Recreation Contractor	1,207.72	1,561.95	1,890.99
Base course drainage layers, aggregate base course for concrete slabs and capillary water barrier, 1" minus graded gravel, 4" compacted thickness	Recreation Contractor	547.86	708.55	857.82
Park Benches	**Recreation Contractor**	**3,654.02**	**4,725.77**	**5,721.32**
Site seating, classic park bench, recycled plastic, various colors, 8' long	Recreation Contractor	2,117.68	2,738.82	3,315.78
Sidewalks, driveways, and patios, sidewalk, concrete, cast-in-place with 6 x 6 - W1.4 x W1.4 mesh, broomed finish, 3000 psi, 4" thick, excludes base	Recreation Contractor	619.74	801.52	970.37
Base course drainage layers, aggregate base course for concrete slabs and capillary water barrier, 1" minus graded gravel, 4" compacted thickness	Recreation Contractor	916.59	1,185.44	1,435.16
Vault Toilet	**Recreation Contractor**	**53,000.00**	**68,545.34**	**82,985.27**
Vault Toilet	Recreation Contractor	53,000.00	68,545.34	82,985.27
Trash Receptacles	**Recreation Contractor**	**1,228.68**	**1,589.06**	**1,923.81**
Trash receptacles, fiberglass, circular, 24" diameter, 30" high, 30 gallon capacity	Recreation Contractor	958.68	1,239.86	1,501.06
Concrete Slabs for Trash and Recycling Receptacles	Recreation Contractor	270.00	349.19	422.76
Recycling Receptacles	**Recreation Contractor**	**614.34**	**794.53**	**961.91**
Trash receptacles, fiberglass, circular, 24" diameter, 30" high, 30 gallon capacity	Recreation Contractor	479.34	619.93	750.53
Concrete Slabs for Trash and Recycling Receptacles	Recreation Contractor	135.00	174.60	211.38
Information Kiosk with Roof	**Recreation Contractor**	**2,130.00**	**2,754.75**	**3,335.07**
Kiosks, rectangular, 5' x 9' x 7' 6" h, 1/4" fiberglass wall	Recreation Contractor	2,130.00	2,754.75	3,335.07
Accessible Canoe Launch	**Recreation Contractor**	**8,426.03**	**10,897.46**	**13,193.14**
Jetties, docks, floating, polystyrene flotation, galvanized steel frame and wood deck, 8' wide, includes anchors, minimum	Recreation Contractor	8,426.03	10,897.46	13,193.14
Accessible Fishing Structure	**Recreation Contractor**	**1,668.10**	**2,157.37**	**2,611.85**
Sidewalks, driveways, and patios, sidewalk, concrete, cast-in-place with 6 x 6 - W1.4 x W1.4 mesh, broomed finish, 3000 psi, 4" thick, excludes base	Recreation Contractor	1,132.23	1,464.33	1,772.81
Base course drainage layers, aggregate base course for concrete slabs and capillary water barrier, 1" minus graded gravel, 4" compacted thickness	Recreation Contractor	535.87	693.04	839.04
Accessible Trail to Fishing Structure	**Recreation Contractor**	**11,349.93**	**14,678.96**	**17,771.27**
Sidewalks, driveways, and patios, sidewalk, concrete, cast-in-place with 6 x 6 - W1.4 x W1.4 mesh, broomed finish, 3000 psi, 4" thick, excludes base	Recreation Contractor	9,435.29	12,202.74	14,773.40
Base course drainage layers, aggregate base course for concrete slabs and capillary water barrier, 1" minus graded gravel, 4" compacted thickness	Recreation Contractor	1,914.64	2,476.22	2,997.87
Parking Lot	**Recreation Contractor**	**23,475.00**	**30,360.41**	**36,756.21**
Topsoil stripping and stockpiling, loam or topsoil, remove and stockpile on site, 200 HP dozer, 6" deep, 300' haul	Recreation Contractor	1,463.69	1,893.00	2,291.79
Compaction, structural, 5 tons, steel wheel tandem roller	Recreation Contractor	248.66	321.60	389.35
Base course drainage layers, aggregate base course for concrete slabs and capillary water barrier, 1" minus graded gravel, 6" compacted thickness	Recreation Contractor	21,762.64	28,145.81	34,075.08
Minnesota River Landing	**Recreation Contractor**	**24,782.03**	**32,050.80**	**38,802.70**
Trash Receptacles	**Recreation Contractor**	**614.34**	**794.53**	**961.91**
Trash receptacles, fiberglass, circular, 24" diameter, 30" high, 30 gallon capacity	Recreation Contractor	479.34	619.93	750.53
Concrete Slabs for Trash and Recycling Receptacles	Recreation Contractor	135.00	174.60	211.38
Recycling Receptacles	**Recreation Contractor**	**614.34**	**794.53**	**961.91**
Trash receptacles, fiberglass, circular, 24" diameter, 30" high, 30 gallon capacity	Recreation Contractor	479.34	619.93	750.53

Currency in US dollars

Description	Contractor	DirectCost	CostToPrime	ContractCost
Concrete Slabs for Trash and Recycling Receptacles	Recreation Contractor	135.00	174.60	211.38
Accessible Fishing Structure	**Recreation Contractor**	**1,003.79**	**1,298.20**	**1,571.69**
Sidewalks, driveways, and patios, sidewalk, concrete, cast-in-place with 6 x 6 - W1.4 x W1.4 mesh, broomed finish, 3000 psi, 4" thick, excludes base	Recreation Contractor	679.34	878.60	1,063.68
Base course drainage layers, aggregate base course for concrete slabs and capillary water barrier, 1" minus graded gravel, 4" compacted thickness	Recreation Contractor	324.44	419.61	508.00
Accessible Trail to Fishing Structure	**Recreation Contractor**	**4,655.15**	**6,020.55**	**7,288.85**
Sidewalks, driveways, and patios, sidewalk, concrete, cast-in-place with 6 x 6 - W1.4 x W1.4 mesh, broomed finish, 3000 psi, 4" thick, excludes base	Recreation Contractor	3,774.12	4,881.10	5,909.36
Base course drainage layers, aggregate base course for concrete slabs and capillary water barrier, 1" minus graded gravel, 4" compacted thickness	Recreation Contractor	881.04	1,139.45	1,379.49
Rustic Fishing Structures	**Recreation Contractor**	**15,764.41**	**20,389.25**	**24,683.29**
Public Storm Utility Drainage Piping, concrete, box culvert, precast, base price, 8' long, 10' x 8', excludes excavation or backfill	Recreation Contractor	11,745.20	15,190.16	18,390.16
Base course drainage layers, aggregate base course for concrete slabs and capillary water barrier, 1" minus graded gravel, 4" compacted thickness	Recreation Contractor	270.34	349.63	423.29
Earthwork	**Recreation Contractor**	**2,759.49**	**3,568.87**	**4,320.70**
Structural excavation for minor structures, bank measure, for spread and mat footings, elevator pits, and small building foundations, sand & gravel, 2 C.Y. bucket, machine excavation, hydraulic backhoe	Recreation Contractor	2,654.49	3,433.07	4,156.29
Compaction, 2 passes, 18" wide,12" lifts, walk behind, vibrating plate	Recreation Contractor	105.00	135.80	164.41
Select Granular Fill	**Recreation Contractor**	**989.39**	**1,279.58**	**1,549.14**
Borrow, select granular fill, 1 C.Y. bucket, loading and/or spreading, shovel	Recreation Contractor	954.05	1,233.88	1,493.81
Compaction, 2 passes, 18" wide,12" lifts, walk behind, vibrating plate	Recreation Contractor	35.34	45.70	55.33
Information Kiosk with Roof	**Recreation Contractor**	**2,130.00**	**2,754.75**	**3,335.07**
Kiosks, rectangular, 5' x 9' x 7' 6" h, 1/4" fiberglass wall	Recreation Contractor	2,130.00	2,754.75	3,335.07
Upper Pool Landing	**Recreation Contractor**	**6,974.00**	**9,019.53**	**10,919.61**
Trash Receptacles	**Recreation Contractor**	**614.34**	**794.53**	**961.91**
Trash receptacles, fiberglass, circular, 24" diameter, 30" high, 30 gallon capacity	Recreation Contractor	479.34	619.93	750.53
Concrete Slabs for Trash and Recycling Receptacles	Recreation Contractor	135.00	174.60	211.38
Accessible Fishing Structure	**Recreation Contractor**	**669.19**	**865.47**	**1,047.79**
Sidewalks, driveways, and patios, sidewalk, concrete, cast-in-place with 6 x 6 - W1.4 x W1.4 mesh, broomed finish, 3000 psi, 4" thick, excludes base	Recreation Contractor	452.89	585.73	709.12
Base course drainage layers, aggregate base course for concrete slabs and capillary water barrier, 1" minus graded gravel, 4" compacted thickness	Recreation Contractor	216.30	279.74	338.67
Accessible Trail to Fishing Structure	**Recreation Contractor**	**3,560.47**	**4,604.79**	**5,574.84**
Sidewalks, driveways, and patios, sidewalk, concrete, cast-in-place with 6 x 6 - W1.4 x W1.4 mesh, broomed finish, 3000 psi, 4" thick, excludes base	Recreation Contractor	2,830.59	3,660.82	4,432.02
Base course drainage layers, aggregate base course for concrete slabs and capillary water barrier, 1" minus graded gravel, 4" compacted thickness	Recreation Contractor	729.88	943.97	1,142.82
Information Kiosk with Roof	**Recreation Contractor**	**2,130.00**	**2,754.75**	**3,335.07**
Kiosks, rectangular, 5' x 9' x 7' 6" h, 1/4" fiberglass wall	Recreation Contractor	2,130.00	2,754.75	3,335.07
Other Landings	**Recreation Contractor**	**74,128.46**	**95,870.95**	**116,067.36**
Trash Receptacles	**Recreation Contractor**	**2,457.35**	**3,178.12**	**3,847.63**
Trash receptacles, fiberglass, circular, 24" diameter, 30" high, 30 gallon capacity	Recreation Contractor	1,917.35	2,479.73	3,002.12
Concrete Slabs for Trash and Recycling Receptacles	Recreation Contractor	540.00	698.39	845.51
Rustic Fishing Structures	**Recreation Contractor**	**63,151.10**	**81,673.85**	**98,879.46**
Public Storm Utility Drainage Piping, concrete, box culvert, precast, base price, 8' long, 10' x 8', excludes excavation or backfill	Recreation Contractor	46,980.78	60,760.64	73,560.63
Base course drainage layers, aggregate base course for concrete slabs and capillary water barrier, 1" minus graded gravel, 4" compacted thickness	Recreation Contractor	1,216.03	1,572.70	1,904.01
Earthwork	**Recreation Contractor**	**11,037.97**	**14,275.49**	**17,282.80**
Structural excavation for minor structures, bank measure, for spread and mat footings, elevator pits, and small building foundations, sand & gravel, 2 C.Y. bucket, machine excavation, hydraulic backhoe	Recreation Contractor	10,617.95	13,732.29	16,625.16
Compaction, 2 passes, 18" wide,12" lifts, walk behind, vibrating plate	Recreation Contractor	420.01	543.21	657.64
Granular Fill	**Recreation Contractor**	**3,916.32**	**5,065.01**	**6,132.02**
Borrow, select granular fill, 1 C.Y. bucket, loading and/or spreading, shovel	Recreation Contractor	3,776.45	4,884.11	5,913.01
Compaction, 2 passes, 18" wide,12" lifts, walk behind, vibrating plate	Recreation Contractor	139.88	180.91	219.02
Information Kiosk with Roof	**Recreation Contractor**	**8,520.00**	**11,018.99**	**13,340.27**
Kiosks, rectangular, 5' x 9' x 7' 6" h, 1/4" fiberglass wall	Recreation Contractor	8,520.00	11,018.99	13,340.27

Labor ID: LNS2009 EQ ID: EP07R04 Currency in US dollars TRACES MII Version 3.0

MARSH LAKE DAM ROADWAY BRIDGE ESTIMATE PROVIDED

BY MINNESOTA DEPARTMENT OF TRANSPORTION (MNDOT)

BRIDGE COST ESTIMATOR

DATE: 2/25/2011

JEFF SOUTHWARD
2-25-11
1 OF 3

Proposed 5 SPAN Bridge (CORP OF ENGINEER)

Assumptions:

1. width = 1.6667' + 6(shld) + 12(Lane) + 12(Lane) + 6 (shld) + 1.667 = 39.33' out to out
2. L = 450'
3. USED MN DOT 36M PSCB W 4.1' ± Depth of Structure
4. 3 piers P. Lobament wall piers w/ 16" CIP 85' LONG)
5. 1 PIER (FIXED) w/ Footing w/ 16" CIP 75' LONG)
6. 2 - PARADOX TYPE ABUTS w/ 5' EXPOSURE 12" CIP 75' LONG
7. NO REMOVAL OF EXISTING STRUCTURE Included
8. NO MARINE ACCESS Required
9. NO Aesthetic COSTS Added
10. NO RISK OR CONTINGENCY ADDED

39.3333 X 450 = 17,700 SF

Supper Structure

DECK	17,700	X $13.00/SF	= $230,100	
EPOXY REINF	142,000	X $1.10/#	= $156,200	
F RAIL	968	X $65/LF	= $62,920	
36M	2700	X $180/LF	= $486,000	
BEARINGS	60	X $800/EACH	= $48,000	
EXP JOINT	150	X $150/LF	= $22,500	
			$1,005,720	($56.82/SF)

ABUTS

Structure EXC	1	X $5000/LS	= $5,000	
FOOTING CONC.	100	X $350/CY	= $35,000	
" REINF	10,000	X $1.00/LB	= $10,000	
STEM CONC	184	X $600/CY	= $110,400	
" REINF	23,000	X $1.10/lb	= $25,300	
12" CIP Piles	2400	X $40/LF	= $96,000	
			$281,700	($15.92/SF)

PIER 1

	Structure EX	1	X $2,500/LF	= $2,500	
39 X 3 X 7	Stem CONCRET	91	X $600/CY	= $54,600	
	" REINF	11,500	X $1.10/lb	= $12,650	
	16" CIP PILES	850	X $50/LF	= $42,500	
				$112,250	($6.35/SF)
	PIER 3			$112,250	($6.35/SF)
	PIER 4			$112,250	($6.35/SF

PIER 2

	STRUCTURE EXC	1 X $20,000/LS	= $20,000	
42X6X3.5	FOOTING CONC	36 X $350/CY	= $12,600	
	" REBAR	3600 X $1.00/LB	= $3,600	
	STEM CONC	91 X $600/CY	= $54,600	
	" REBAR	11,500 X $1.10/LB	= $12,600	
	16" CIP PILES	900 X $50/LF	= $45,000	
			$148,400	($8.38/SF)

Superstructure → $1,005,720 ($56.82/SF)

Abutments	$ 281,700
PIER 1	$ 112,250
" 2	$ 148,400
" 3	$ 112,250
" 4	$ 112,250

Substructure → $766,850 ($43.33/SF)

APP PANELS $26,500 ($1.50/SF)

$1,799,070 ($101.65/SF)

MISC MISSING ITEMS ±5% $ 90,000

MOBILIZATION ±5% $ 95,000

1,984,070 SAY $2,000,000

OPERATION AND MAINTENANCE FEASIBILITY ESTIMATE				*Life Cycle 50 Years *Rate of Return 4.125%	
MARSH LAKE				EQUIVALENT AVERAGE ANNUAL O&M / MAJOR REPLACEMENT VALUE	
ACCOUNT CODE	ITEM DESCRIPTION	ESTIMATED O&M CYCLE	% ORIGINAL QUANTITY TO REPLACE	PRESENT VALUE	ANNUAL COST
				$1,325,446	$63,026
	Inspections				
	Periodic Inspections				
	Every 5 years	5 Yrs		$77,461	$3,683
	Routine Annual Inspections	1 Yr		$78,863	$3,750
	Total Inspections			$156,323	$7,433
		Yrs			
02	Relocations				
	2 Two Lane Bridge				
	Deck Area	20 Yrs	10%	$106,659	$5,072
03	Reservoirs				
	3 Fishway				
	Rockfill Boulders	10 Yrs	10%	$23,812	$1,132
	Riprap for Channel Bed	10 Yrs	10%	$75,615	$3,596
	Bedding for Channel Bed	10 Yrs	10%	$20,395	$970
	4 Drawdown Structure				
	Concrete Structure				
	Concrete Wall for Structure	20 Yrs	5%	$19,295	$917
	Downstream Concrete Apron	20 Yrs	5%	$18,991	$903
	Concrete Walkway	20 Yrs	5%	$3,430	$163
	Railing Pipe	20 Yrs	100%	$8,365	$398
	Stoplogs (per bay)	10 Yrs	5%	$30,066	$1,430
	Scour Protection D/S of Struct				
	R270 Riprap	10 Yrs	10%	$137,345	$6,531
	B3 Bedding	10 Yrs	10%	$37,843	$1,799
	Embankments on Side of Fishway and				
	3 Drawdown Structure				
	4 Impervious Fill	10 Yrs	5%	$34,753	$1,653
	Topsoil	10 Yrs	5%	$2,366	$112
	Seeding	10 Yrs	5%	$1,503	$71
	Mowing	1 Yr	100%	$12,955	$616
	Spray Weeds & Brush on Riprap	1 Yr	100%	$5,687	$270
	Existing Spillway				
	Concrete for Spillway Crest	20 Yrs	5%	$2,165	$103
	3 Pedestrian Bridge over Spillway				
	Concrete Deck	20 Yrs	5%	$1,745	$83
10	Breakwaters				
	7 Breakwater A	10 Yrs	5%	$169,206	$8,046
	7 Breakwater B	10 Yrs	5%	$115,700	$5,502
	7 Breakwater C	10 Yrs	5%	$143,597	$6,828
11	Levees and Floodwalls				
	2 Levees				
	Levee Fill	10 Yrs	5%	$36,793	$1,750
	Topsoil	10 Yrs	5%	$4,942	$235
	Seeding	10 Yrs	5%	$3,116	$148
	Mowing	1 Yr	100%	$27,760	$1,320
	Spray Weeds & Brush on Riprap	1 Yr	100%	$2,524	$120
	Roadway Aggregate	5 Yrs	5%	$15,465	$735
	Riprap	10 Yrs	10%	$29,565	$1,406
	Bedding	10 Yrs	10%	$15,190	$722
	5 Lousiburg Road Culverts				
	Concrete Structure	20 Yrs	2%	$5,027	$239
	Stoplog Structure	10 Yrs	5%	$5,906	$281
	Riprap: Scour Hole	10 Yrs	10%	$4,653	$221
	Bedding: Scour Hole	10 Yrs	10%	$1,247	$59
14	Recreation Facilities	10 Yrs	5%	$45,442	$2,161
	Total O&M			$1,325,446	$63,026

NOTE 1: UNIT PRICING INCLUDES CONTINGENCIES AND QUANTITY ADJUSTMENT FACTORS

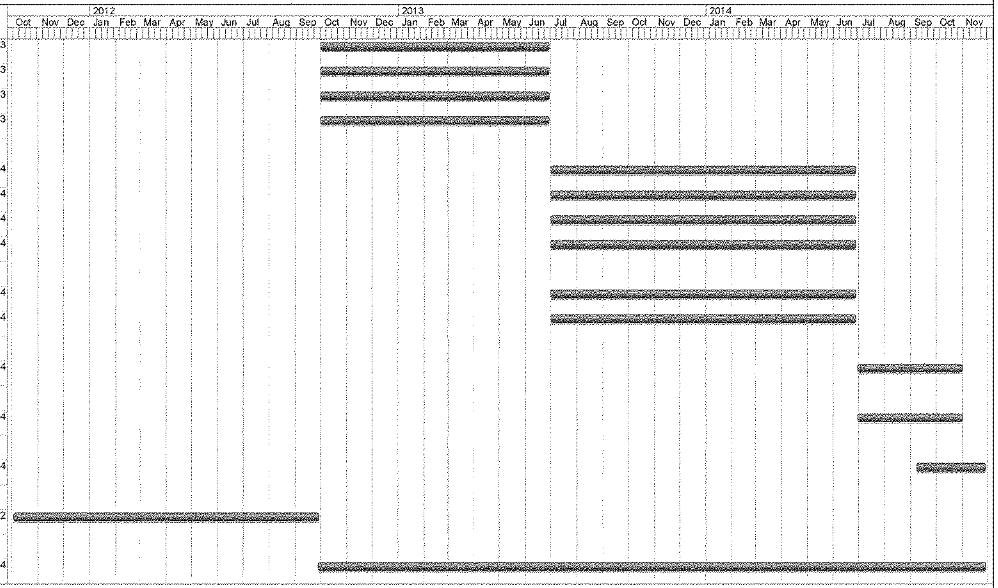
PRICING FOR APRIL 2010

MARSH LAKE ECOSYSTEM RESTORATION PROJECT
PROJECT DEVELOPMENT PLAN: FEASIBILITY STUDY
ABBREVIATED RISK ANALYSIS

Typical Risk Elements	TWO LANE BRIDGE	FISHWAY	DRAWDOWN STRUCTURE	EMBANKMENTS D/S FISHWAY & DRAWDOWN STRUCTURE	MODIFY EXISTING SPILLWAY	PEDESTRIAN BRIDGE OVER SPILLWAY	BREAKWATERS A, B, & C	DIVERSION DIKES A & B	ROAD RAISE	LOUISBURG ROAD CULVERTS	RECREATION FACILITIES	REMAINING CONSTRUCTION ITEMS	PLANNING, ENGINEERING, & DESIGN	CONSTRUCTION MANAGEMENT
	Selected Work Breakdown Structure Items													
Project Scope	2	1	2	2	2	2	1	1	1	1	1	-	2	2
Acquisition Strategy	2	2	2	2	2	2	2	2	2	2	2	2	-	4
Construction Complexity	2	2	2	2	4	2	2	2	-	1	-	-	-	3
Volatile Commodities	2	3	3	-	1	3	3	1	1	1	3	-	-	-
Quantities	2	4	3	3	-	2	2	2	2	1	1	-	-	2
Fabrication & Project Installed Equipment	2	-	2	-	-	4	-	-	-	2	1	-	-	1
Cost Estimating Method	2	2	2	2	2	2	1	1	1	2	2	1	-	2
External Project Risks	2	2	2	2	2	1	4	2	3	2	1	1	1	2
Weighted Summation	16	16	18	13	13	18	15	11	10	12	11	4	3	16
Weighted %	33.3%	33.3%	37.5%	27.1%	27.1%	37.5%	31.3%	22.9%	20.8%	25.0%	22.9%	8.3%	6.3%	33.3%

MARSH LAKE DAM ECOSYSTEM RESTORATION
ESTIMATED PROJECT SCHEDULE

ID	Task Name	Duration	Start	Finish
1	2 Two Lane Bridge	195 days	Mon 10/1/12	Fri 6/28/13
2	11 Diversion Dike A	195 days	Mon 10/1/12	Fri 6/28/13
3	11 Diversion Dike B	195 days	Mon 10/1/12	Fri 6/28/13
4	11 Road Raise	195 days	Mon 10/1/12	Fri 6/28/13
5				
6	3 Fishway	260 days	Mon 7/1/13	Fri 6/27/14
7	3 Mod Exist Spillway	260 days	Mon 7/1/13	Fri 6/27/14
8	3 Ped Bridge Over Spillway	260 days	Mon 7/1/13	Fri 6/27/14
9	3 Embank D/S Spillway	260 days	Mon 7/1/13	Fri 6/27/14
10				
11	3 Embank D/S Drawdown	260 days	Mon 7/1/13	Fri 6/27/14
12	3 Drawdown Structure	260 days	Mon 7/1/13	Fri 6/27/14
13				
14	11 Louisburg Road Culverts	90 days	Mon 6/30/14	Fri 10/31/14
15				
16	11 Fish Pond Levee Breach	90 days	Mon 6/30/14	Fri 10/31/14
17				
18	14 Recreation Facilities	60 days	Mon 9/8/14	Fri 11/28/14
19				
20	30 Planning, Eng, &Design	260 days	Mon 10/3/11	Fri 9/28/12
21				
22	31 Supervision & Administration	566 days	Fri 9/28/12	Fri 11/28/14



Project: Marsh Lake Project Schedule.
Date: Thu 3/31/11

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

Appendix H – Geotechnical

Marsh Lake Dam

Ecosystems Restoration Feasibility Study

Geology and Geotechnical Appendix

OCTOBER 2010

TABLE OF CONTENTS

1. PURPOSE:

This appendix presents the general geology and specific geotechnical analysis for the Marsh Lake project.

2. SELECTED PLAN SUMMARY:

The tentatively selected plan features that require geotechnical input are listed below followed by their geotechnical-input requirement:

- Modifications to the Marsh Lake Dam to enable passive and active water level management. Provide structural section with soil parameters.
- Restore the Pomme de Terre River to its former channel near its confluence with the Minnesota River. Construct a bridge over the Pomme de Terre River to maintain access to the Marsh Lake Dam. Compute stable slopes, estimate settlement, and find suitable borrow.
- Provide for fish passage between Lac qui Parle Lake and Marsh Lake and the Pomme de Terre River. Design riprap and bedding.
- Construct rock wave-break islands in Marsh Lake to reduce wind fetch, wave action, and sediment resuspension to restore aquatic vegetation. Estimate amount of displacement expected.
- Install gated culverts in the Louisburg Grade Road to enable water level management in upper Marsh Lake. Design riprap and bedding.
- Construct recreational and educational features including a trail bridge over Marsh Lake Dam to connect with the Minnesota State Trail, fishing access on Marsh Lake, canoe access on the Pomme de Terre River, and an improved recreation area at Marsh Lake Dam. Provide structural section with soil parameters.

The selected plan is shown in the main report. Table H-1 below lists the approximate quantities of the various project features of the proposed plan along with their respective geotechnical design aspects.

Table H-1

Feature	Approximate Quantity	Geotechnical Design Aspects
Topsoil	4,000 yd^3	-Locate borrow area if not enough stripping
Excavation	35,000 yd^2	-Locate disposal area if excess
Diversion Dikes, Containment Levees (impervious fill)	35,000 yd^3	-Compute stable side slopes -Estimate settlement/displacement -Find and control areas of high seepage gradients -Locate borrow or disposal area
Breakwater Structures, Fishway Structure	125,000 TON	-Rock gradation -Rock source -Estimate settlement/displacement
Drawdown Structure	1	-Cofferdam design -Seepage analyses -Foundation design (bearing and settlement)
Louisburg Road Culverts	3	-Seepage check -Riprap design for pipe inlet/outlet
Bridges	2	Design of bridge foundations

The cost estimate assumed a sheet pile cofferdam and a thirty day dewatering effort to allow construction of the drawdown structure. The bridge over the Pomme de Terre River assumed a pile foundation. Assumptions and costs for this bridge were provided by the Minnesota DOT.

3. TOPOGRAPHY and PHYSIOGRAPHY

As the last glaciers in the southern Minnesota area retreated northward above the continental divide at Browns Valley and into the Red River Valley, vast Lake Agassiz - headwaters of the glacial River Warren - was formed. The River Warren, flowing to the southeast, began cutting and shaping the Minnesota Valley to its present form. Eventually, the retreating ice margin uncovered lower outlets, and Lake Agassiz, now draining to the north, was reduced to such a low elevation that River Warren ceased to flow. In its place, the Minnesota River became established.

The 2020 square mile, Upper Minnesota River Watershed, is one of the 13 major watersheds of the Minnesota River Basin. Situated within the Northern Glaciated Plains Ecoregion, the watershed can further be divided into three geomorphic settings: the headwaters flowing off the Coteau des Prairies, the lower basin-situated within the Blue Earth Till Plain, and the Minnesota River Valley-carved by the glacial River Warren.

The portion of the watershed within the Blue Earth Till Plain is represented by nearly level to gently sloping lands, ranging from 0-6% in steepness. Soils are predominantly loamy, with landseapes having a complex mixture of well and poorly drained soils. Drainage of depressional areas is often poor, and tile drainage is common. Water erosion potential is moderate on much of the land within this geomorphic setting.

The Coteau des Prairies or Highland of the Prairies, so named by French explorers, is a morainal plateau that occupies the headwaters of the Upper Minnesota River and several other rivers. In addition to being an impressive topographic barrier, the Coteau acts as an important drainage divide. Its well drained southwestern side sheds water into the Big Sioux River, while waters on the northeastern side flow into the Des Moines and Minnesota Rivers. The Coteau is characterized by landscapes with long northeast facing slopes which are undulating to rolling (2-18%). Soils are predominantly loamy and well drained.

Tributaries draining the Coteau and entering the Upper Minnesota River from South Dakota include the Little Minnesota River - headwaters of Big Stone Lake and the Whetstone River. Alluvial deposits at the mouth of the Whetstone River formed a natural dam and originally impounding Big Stone Lake. In 1973 a diversion was completed that directed flows of the Whetstone River directly into Big Stone Lake. Further modifications were made in the late 1980's with the completion of the Big Stone/Whetstone River Control Structure. This structure can redirect up to 1460 cubic feet per second (cfs) of flow from the Whetstone directly into the Minnesota River, bypassing the deposition of unwanted sediments and nutrients into Big Stone Lake during high flow periods.

Below Ortonville, the Minnesota is a small but distinct river. It flows for fifteen miles, passing through the Big Stone-Whetstone Reservoir (constructed during the 1970's) and further down receives the waters of the Yellow Bank River whose headwaters are also in South Dakota. The Upper Minnesota then meets Marsh Lake and Lac Qui Parle (meaning the Lake Which Talks). Both Marsh and Lac Qui Parle lakes are natural impoundments, dammed by alluvial fans of sediment deposited at the mouths of two major tributaries, the Pomme De Terre and Lac Qui Parle rivers respectively. The Pomme De Terre River comes down from the hills of the lake country to the north. The Lac Qui Parle River originates in the Coteau des Prairies, flows northeast through the prairies of the southwest, then confluences with the Minnesota River by Watson. Although they are natural reservoirs, the lakes were subject to some natural fluctuation; thus dams were built at the outlets for greater water control. The outlet of the Upper Minnesota River Watershed is below the Lac Qui Parle Reservoir, 288 miles upstream from the mouth of the Minnesota River.

Counties within the watershed include sections of Big Stone, Chippewa, Lac Qui Parle, Swift and Traverse. Land use within the watershed is primarily agricultural, with 76% of the available acres utilized for production of grain crops, mainly corn and soybeans. Of these acres, approximately 15% have been tiled to improved drainage. The majority of the crop-lands (82%) are classified as moderately productive. As of 1994, roughly eight percent of the agricultural acres within the Upper Minnesota River Watershed were classified as grasslands enrolled in the Conservation Reserve Program (CRP), a voluntary federal program that offers annual rental payments to farmers in exchange for planting areas of grass and trees on lands subject to erosion. Approximately thirty nine percent of the lands draining into the Upper Minnesota River have a high water erosion potential and twenty six percent have the potential for significant wind erosion. Water erosion potential is highest on lands draining the Coteau region.

4. REGIONAL GEOLOGY and STRATIGRAPHY

Marsh Lake is part of the Minnesota River flowage. The pertinent geology and stratigraphy are related to the last glacier that retreated from the area approximately 14000 years ago. As the glacier retreated north, the melting ice margin headed the ancestral Minnesota River. The glacier eventually retreated north of the topographic divide, near Browns Valley, and meltwater ponded behind the divide to form Glacial Lake Agassiz. When the meltwater raised the lake enough to overtop the drainage divide, a southern outlet stream, the River Warren, discharged from the lake. The River Warren carved the present oversized valley now occupied by the Minnesota River. Lake Agassiz ultimately drained to the northeast, allowing the Minnesota River to aggrade and adjust to the local conditions. The original Marsh Lake was formed by the damming effect of a delta at the mouth of the Pomme de Terre River. The present Marsh Lake is ponded behind a man-made embankment nearly two miles long that connects the lower river valley walls at elevation 950.

<u>Bedrock</u>- Bedrock lies at an estimated depth greater than 200 feet beneath the glacial sediments in the region. The bedrock is likely composed of Paleozoic Era, Cretaceous Period sedimentary rock or granitic intrusive rocks. The bedrock lies well below the influence of the proposed project.

<u>Glacial Till</u>- Overlying the bedrock are the numerous till layers that were deposited

predominately out of the Des Moines lobe, though some older units are encountered in the area. Dark gray, medium stiff to hard, sandy, gravelly till was encountered in boring 09-15M at 930 feet and older borings taken in 1972 and 1986 show the average till elevation is about 927 feet except for the area just east of the concrete dam where the till surface dips to about 885. A two to three-foot- thick zone of soft to medium stiff reworked or disturbed till tops the firm till beneath the west portion of the embankment. Till deposits vary in thickness from over 300 feet deep within the Bigstone Moraine, north of the project area, to nonexistent at exposed bedrock along the Minnesota River farther downstream.

Stream sediment from Glacial River Warren- As the River Warren flowed through the underlying till it both cut channels and deposited sediments. These deposits are found as stratified sand and gravel bars, and may be interbedded with finer sediments from stagnant periods, as seen in borehole 09-17M. This unit is found locally at elevation 935 feet, and extends below the end of the borehole at elevation 905.5.

Present day Alluvium- Recent, upper level soils consist of stream sediments of the Pomme de Terre River, channel fill of organics and clays and lake sediments from Marsh Lake. Varying OH, OL and CH are encountered in most boreholes, and these fine sediments vary in thickness depending on the depositional mechanism, and the channel topography from the stream cuts. The upper portion of the alluvium is commonly highly organic and very soft to medium stiff. The lower portion is sparsely organic and stiff. It contains shells, and ranges from black to greenish gray to gray.

Embankment fill- Borings taken in 1972 and 1986, and 09-16M show the embankment material averages fourteen feet in thickness and is clay, variably silty and sandy with minor amounts of organics and roots.

5. SEISMIC RISK and EARTHQUAKE HISTORY

According to Corps of Engineers Regulation ER 1110-2-1806, Earthquake Design Analysis for Corps of Engineers Projects, the entire state of Minnesota is located within earthquake Seismic Risk Zone 0. The Uniform Building Code of the International Conference of Building Officials assigns every location in the United States to a four grade Seismic Risk Zone (0 = least risk, 3 = greatest risk).

In Minnesota there are few faults that could possibly affect the project. The Morris fault extends diagonally from the town of Morris, Minnesota to the Brainerd area in west-central Minnesota, roughly 30 miles southeast of Marsh Lake. The Morris fault, it is confined to the Precambrian bedrock and is not considered tectonically active, although some seismic activity has been associated with the Morris fault. In 1975, an earthquake with a Modified Mercalli Intensity of VI occurred near the town of Morris. This earthquake occurred about 10 miles west-northwest of Morris at a depth of 3-5 miles. It is one of the best documented earthquakes in Minnesota history, and possibly the largest. In Fargo and in Valley City, North Dakota, a Modified Mercalli Intensity of II (felt by persons at rest, on upper floors, or favorably placed) was assigned for this event. However, it was not felt north of Grand Forks, North Dakota. The Modified Mercalli Intensity Scale ranges from I (not felt) to XII (damage nearly total). Five other earthquakes have been linked to the Morris fault since the year 1860. The most recent earthquake in Minnesota occurred along the western edge of the Morris fault in 1993 near the town of Graceville. It had a magnitude of 4.1 on the Richter scale and a Mercalli Intensity of V. The Graceville earthquake occurred at an estimated depth of 7 miles.

Eighteen recorded earthquakes have occurred in Minnesota since 1860. Some are associated with glacial isostatic rebound, particularly in the northeast region of the state near Duluth. No earthquake has exceeded the magnitude or intensity of the Morris event in 1975. An approximate frequency of between 10 and 30 years has been established for minor earthquakes in Minnesota. The seismic risk assessment for the Red River Valley region relies largely on earthquake history. The absence of major or catastrophic earthquakes, coupled with the infrequency of these earthquakes in general, implies an extremely low risk level for seismic activity in the vicinity of Marsh Lake.

6. SUBSURFACE INVESTIGATIONS

A total of 21 soil borings including several test pits and several hand augers were advanced by the St. Paul District in the project area in the years from 1972 through 2009. However, for the selected plan, the 5 borings shown on Plates H-3 taken in 2009 contain the most relevant geotechnical information. Therefore, only these boring locations and logs are presented on Plate H-1 through H-3. Borings 09-18A through 09-21A are short, hand auger borings taken for environmental sampling and provide no meaningful geotechnical information. As a result, these borings were not included on Plate H-3. Limited index testing was completed to delineate the contact between the different geologic units. Tests taken from samples consist of Atterberg limits, natural moisture content, consolidation, and triaxial compression tests. Results of the all the laboratory tests taken in the Marsh Lake Dam area are shown on the Plate H-5. Table H-2, below, summarizes the consolidation tests results:

Table H-2: Consolidation Testing Summary

Formation	LL	PL	PI	Liquidity	ω_0	C_c	e_o	γ_{sat}	γ_{moist}	OCR
09-15MU - OL	47	16	31	0.60	34.7%	0.37	1.025	112.9	109.5	2.5
09-17MU - OH	81.2%	31.4%	49.8%	0.73	68.0%	0.53	1.755	97.7	97.4	1.0

7. SITE HYDROGEOLOGY

Currently insufficient data exists for a detailed site specific groundwater characterization at the Marsh Lake project site. Commonly, groundwater levels in the project area are high. Groundwater will be located within ten feet below the ground surface. Water levels fluctuate seasonally, with fall /winter conditions exhibiting the lowest measured water levels as might be expected.

8. CONSTRUCTION MATERIALS

Borrow Source. The impervious dike borrow will tentatively be obtained from an area shown on Plate H-4. Archeological investigations must be completed before any borrow sites may be used for the project. In addition, geotechnical characterization of the borrow site must occur prior to approval. The investigation should determine the thickness of topsoil present, the thickness and suitability of foundation soils for impervious borrow, and the natural moisture content and Proctor density of the soils.

Concrete Aggregate, Riprap, and Bedding. Sources for fine and coarse concrete aggregate, bedding, and riprap should be available locally. Most commercial aggregates in the Marsh Lake vicinity are obtained from sand and gravel deposits, and quarried rock located along the Minnesota River valley within 40 miles of the project site. Additional investigations will be necessary prior to plans and specifications in order to accurately quantify and test the quality of the stone product available within a reasonable radius of the area.

9. SETTLEMENT AND DISPLACEMENT:

The computer program CSETT was used to estimate the consolidation settlement expected. However, the two consolidation tests that were done for this project resulted in C_c and e_0 that varied by the formation sampled, as shown in the testing summary above in Table H-2. Soil stratigraphy from boring no. 09-17M was used to compute settlement for the diversion dike and boring no. 09-15M was used for the road raise. The CSETT input for both the diversion dike and the road raise is shown on Plate H-6 with the output on Plate H-7. The road raise was computed for two loads. The existing embankment was the first load and the proposed road raise was the second. No overbuild for settlement was included for Diversion Dike B. Table H-5 summarizes the results, below:

Table H-5: Computed Settlement

Feature	Diversion Dike A (Base Elev. 940)	Road Raise
Settlement (inches)	20	8

10. SLOPE STABILITY:

Criteria in EM 1110-2-1902 were used for this analysis. The following tables in this EM define shear strengths, pore pressures, and Factors-of-safety required for static design conditions:

Table 2-1
Shear Strengths and Pore Pressures for Static Design Conditions

Design Condition	Shear Strength	Pore Water Pressure
During Construction and End-of-Construction	Free draining soils – use drained shear strengths related to effective stresses[1]	Free draining soils – Pore water pressures can be estimated using analytical techniques such as hydrostatic pressure computations if there is no flow, or using steady seepage analysis techniques (flow nets or finite element analyses).
	Low-permeability soils – use undrained strengths related to total stresses[2]	Low-permeability soils – Total stresses are used; pore water pressures are set to zero in the slope stability computations.
Steady-State Seepage Conditions	Use drained shear strengths related to effective stresses.	Pore water pressures from field measurements, hydrostatic pressure computations for no-flow conditions, or steady seepage analysis techniques (flow nets, finite element analyses, or finite difference analyses).
Sudden Drawdown Conditions	Free draining soils – use drained shear strengths related to effective stresses.	Free draining soils – First-stage computations (before drawdown) – steady seepage pore pressures as for steady seepage condition. Second- and third-stage computations (after drawdown) – pore water pressures estimated using same techniques as for steady seepage, except with lowered water level.
	Low-permeability soils – Three-stage computations: First stage--use drained shear strength related to effective stresses; second stage--use undrained shear strengths related to consolidation pressures from the first stage; third stage--use drained strengths related to effective stresses, or undrained strengths related to consolidation pressures from the first stage, depending on which strength is lower – this will vary along the assumed shear surface.	Low-permeability soils – First-stage computations--steady-state seepage pore pressures as described for steady seepage condition. Second-stage computations – total stresses are used; pore water pressures are set to zero. Third-stage computations -- same pore pressures as free draining soils if drained strengths are used; pore water pressures are set to zero where undrained strengths are used.

[1] Effective stress shear strength parameters can be obtained from consolidated-drained (CD, S) tests (direct shear or triaxial) or consolidated-undrained (CU, $\bar{R}$) triaxial tests on saturated specimens with pore water pressure measurements. Repeated direct shear or Bromhead ring shear tests should be used to measure residual strengths. Undrained strengths can be obtained from unconsolidated-undrained (UU, Q) tests. Undrained shear strengths can also be estimated using consolidated-undrained (CU, R) tests on specimens consolidated to appropriate stress conditions representative of field conditions; however, the "R" or "total stress" envelope and associated c and ϕ, from CU, R tests should not be used.
[2] For saturated soils use $\phi = 0$. Total stress envelopes with $\phi > 0$ are only applicable to partially saturated soils.

Table 3-1
Minimum Required Factors of Safety: New Earth and Rock-Fill Dams

Analysis Condition[1]	Required Minimum Factor of Safety	Slope
End-of-Construction (including staged construction)[2]	1.3	Upstream and Downstream
Long-term (Steady seepage, maximum storage pool, spillway crest or top of gates)	1.5	Downstream
Maximum surcharge pool[3]	1.4	Downstream
Rapid drawdown	1.1-1.3[4,5]	Upstream

[1] For earthquake loading, see ER 1110-2-1806 for guidance. An Engineer Circular, "Dynamic Analysis of Embankment Dams," is still in preparation.
[2] For embankments over 50 feet high on soft foundations and for embankments that will be subjected to pool loading during construction, a higher minimum end-of-construction factor of safety may be appropriate.
[3] Pool thrust from maximum surcharge level. Pore pressures are usually taken as those developed under steady-state seepage at maximum storage pool. However, for pervious foundations with no positive cutoff steady-state seepage may develop under maximum surcharge pool.
[4] Factor of safety (FS) to be used with improved method of analysis described in Appendix G.
[5] FS = 1.1 applies to drawdown from maximum surcharge pool; FS = 1.3 applies to drawdown from maximum storage pool. For dams used in pump storage schemes or similar applications where rapid drawdown is a routine operating condition, higher factors of safety, e.g., 1.4-1.5, are appropriate. If consequences of an upstream failure are great, such as blockage of the outlet works resulting in a potential catastrophic failure, higher factors of safety should be considered.

Soils parameters for various formations are shown below in Table H-3 for the Marsh Lake borings.

Table H-3

	Unit weights		Unconsolidated-Undrained Strengths (UU)		Consolidated-Drained Strengths (CD)	
	Moist (pcf)	Saturated (pcf)	c in psf	ϕ in degrees	c' in psf	ϕ' in degrees
COMPACTED DIKE FILL (ESTIMATED FROM EARTH MANUAL)	120	120	(1300)	(0)	(0)	(25)
OH DEPOSITS TESTED (ESTIMATED)	97	97	140	0	(0)	(20)
OL DEPOSITS TESTED (ESTIMATED)	110	115	(840)	(0)	200	30
CL TESTED (ESTIMATED)	110	115	(840)	(0)	200	30
CH TESTED (ESTIMATED)	97	97	140	0	(0)	(25)
SM (ESTIMATED)	130	130	- -	- -	(0)	(33)
GW (ESTIMATED)	130	135	- -	- -	(0)	(30)

End-of-Construction (EOC) and steady state seepage design conditions apply to the diversion dikes. These stability cases were analyzed using the computer program SLOPE/W with the soil stratigraphy from boring number 09-17M. Slope stability calculations were completed using the shear strengths and unit weights shown in Table H-3, above. The pool was set equal to elevation 947.1 or maximum storage pool and the toe of slope equal to 936 for the thalweg sections and

940 for the overbank section. UU-strength values for the compacted dike fill was obtained from the *Earth Manual,* Third Edition, 1998, Table 1-3 on page 50 assuming a CL soil is used for construction. For the EOC case, shear strengths obtained from Unconsolidated-Undrained triaxial testing results were used for design. Long-term stability cases utilized CD-shear strengths, fully softened friction angles with zero cohesion, obtained from Figure 5.18 in "Soil Strength and Slope Stability", 1st Edition, page 50 (J. Michael Duncan and Stephen Wright, 2005).

The overbank portion of Dike A assumes a 40 foot toe drain and a tail water of 942.0. The toe drain was needed to draw the phreatic surface away from the downstream embankment slope, in order to meet the long-term minimum required factor of safety. The steepest stable slope computed for the Dike A was 1V:4H. In order to achieve an adequate factor of safety for the Dike A, berms with a 45 foot top width; a top elevation of 940; and side slopes of 1V:4H were needed upstream and downstream. Diversion Dike B did not require a toe drain or stability berms to meet minimum required factors of safety. Selected stability analyses were checked and confirmed with the computer program UTEXAS4. All of the SLOPE/W results are shown in Table H-4 below. In all the cases, the required minimum factors of safety were met. The critical results from the stability analyses (shown in red in Table H-4) are presented on Plates H-8.

Table H-4: Computed Factor-of-Safety

			Block		Circular			
Embankment Section	Shear Strength	FS Required	Optimized	Non-opt.	Optimized	Non-opt.	Crack Defined	Notes
Dike A Thalweg Section	U-U	1.3	1.30	1.38	1.40	1.61	10' Deep	
Dike A Thalweg Section	C-D	1.5	1.66	1.78	1.65	1.68	No Crack Needed	
Dike A Overbank Section	U-U	1.3	1.31	1.38	1.30	1.48	7' Deep	
Dike A Overbank Section	C-D	1.5	1.50	1.81	1.80	1.84	No Crack Needed	With cutoff.
Dike B	U-U	1.3	1.48	1.62	1.52	1.65	Search	
Dike B	C-D	1.5	2.18	2.40	2.17	2.20	No Crack Needed	
Road Raise	U-U	1.3	2.86	3.09	2.81	2.99	Search	
Road Raise	C-D	1.5	1.57	1.87	1.58	2.27	No Crack Needed	

Means required FS not met

Means minimum FS for section

11. SEEPAGE

The amount of seepage for this project is not important because the intent of the project does not involve keeping areas from getting wet from seepage. Seepage was only considered when computing the slope stability during steady state seepage conditions. The pore water pressures used in the stability computations were from steady state conditions computed using SEEP/W. Seepage under the diversion dikes through the near surface sand layers will likely need to be cut off by construction of an impervious backfilled trench beneath the embankment to prevent piping. Seepage under and around the proposed drawdown structure will have to be analyzed as the structural design proceeds.

12. CONSTRUCTABILITY:

The culverts on Louisburg Grade Road, the breakwaters, the fishway, the fish pond notch, and the road raise can be constructed any time. However, the order of construction of excavation of the old Pomme de Terre River channel, the diversion dikes, and bridge over the Pomme de Terre River along Marsh Lake dam is important. The bridge and the excavation of the old Pomme de Terre River channel should be done first. Then Dike A should be constructed next, followed by Dike B. The Dike A needs to be constructed out of impervious fill and is significantly taller requiring compaction of its fill to be stable. This means the site will have to be dewatered. Two dewatering berms built to at least elevation 941 were taken into account in stability computations, so they will need to be left in place. The other cutoff dike that forces the water of the Pomme de Terre River to flow through its former channel can be constructed from pervious fill.

13. ROCK GRADATION:

The calculation of the minimum diameter of the 50 percent-less-than-by-weight rock for the rockfill for fishway is explained in the Hydraulic Appendix and is 1.6 feet. The layer thickness with this diameter and assuming turbulent flow conditions is 54-inches thick and its gradation is shown in Plate H-9 and Table H-5, below:

Table: H-5

Percent Less-than-by-Weight:	Maximum (lbs.)	Minimum (lbs.):
100	2330	930
50	690	470
15	350	150

14. FUTURE WORK:

- Design of an impervious cut-off of the sand layer for thalweg portion of Dike A.
- Stability evaluation of the slopes for the bridge over the Pom de Terre River, the water control structure, spillway alterations, and culvert at the Louis Grade Road.
- Seepage analysis under/around the drawdown structure.
- Define riprap gradation and extent of riprap for downstream of Louisburg Grade road culverts.
- Test the borrow sites for suitability as impervious fill; prior to borrow site approval determine the thickness of topsoil, natural moisture content, and Proctor density.

- Estimate displacement expected at the proposed breakwaters.

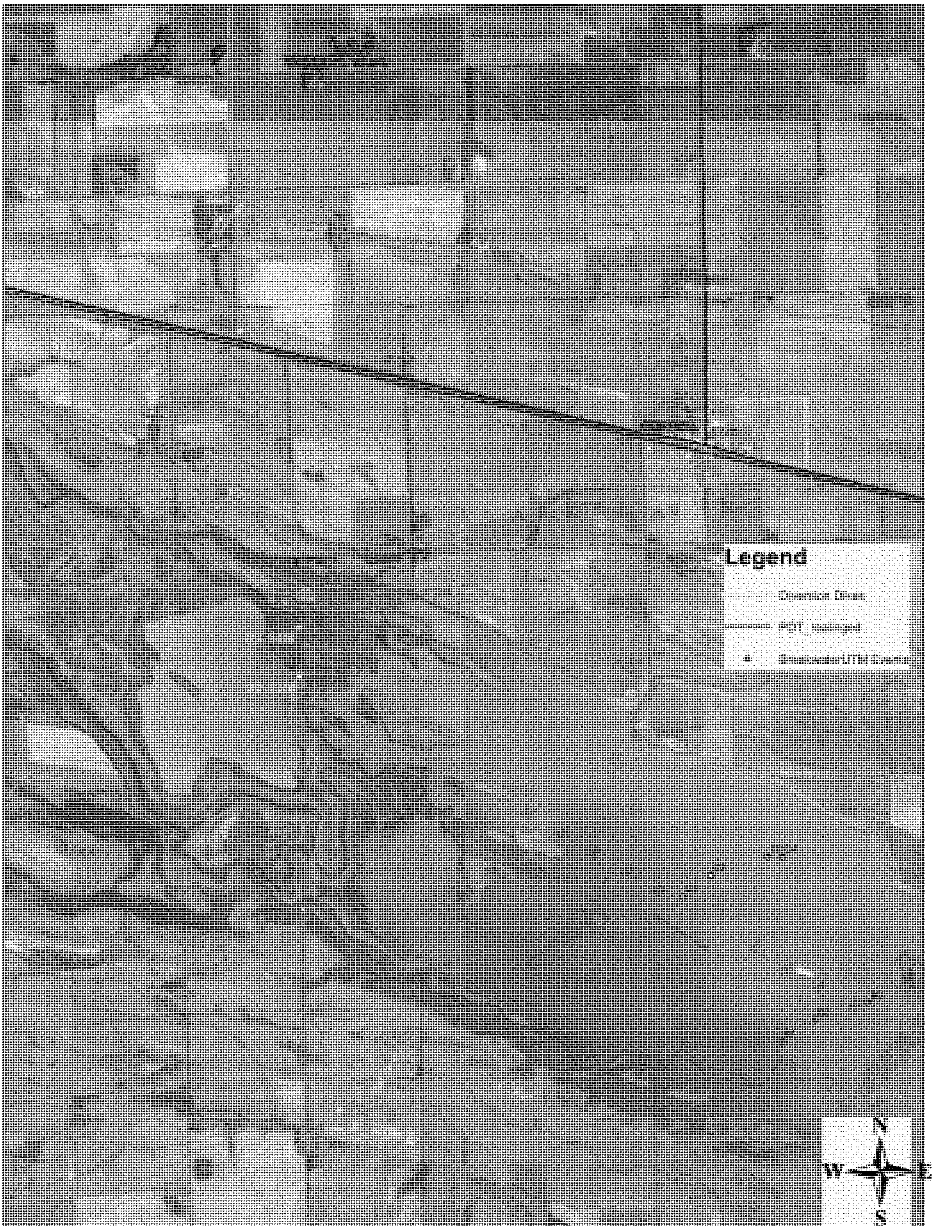
Bibliography

Bureau of Reclamation, US Department of the Interior (2005) *Earth Manual: A Guide to the Use of Soils as Foundations and as Construction Materials for Hydraulic Structures,* New Edition, University Press of the Pacific

Duncan, J. Michael and Stephen G.Wright (2005). *Soil Strength and Slope Stability.* New York: John Wiley & Sons, Inc.

Naval Facilities Engineering Manual. (2005). *Soil Mechanics, Foundations, and Earth Structures.* Washington, D.C.: U.S. Government Printing Office.

Marsh Lake Dam: Boring Locations



St. Paul District

0 2,000 4,000 8,000 Feet

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PLATE H-1

Marsh Lake Project: Boring Locations

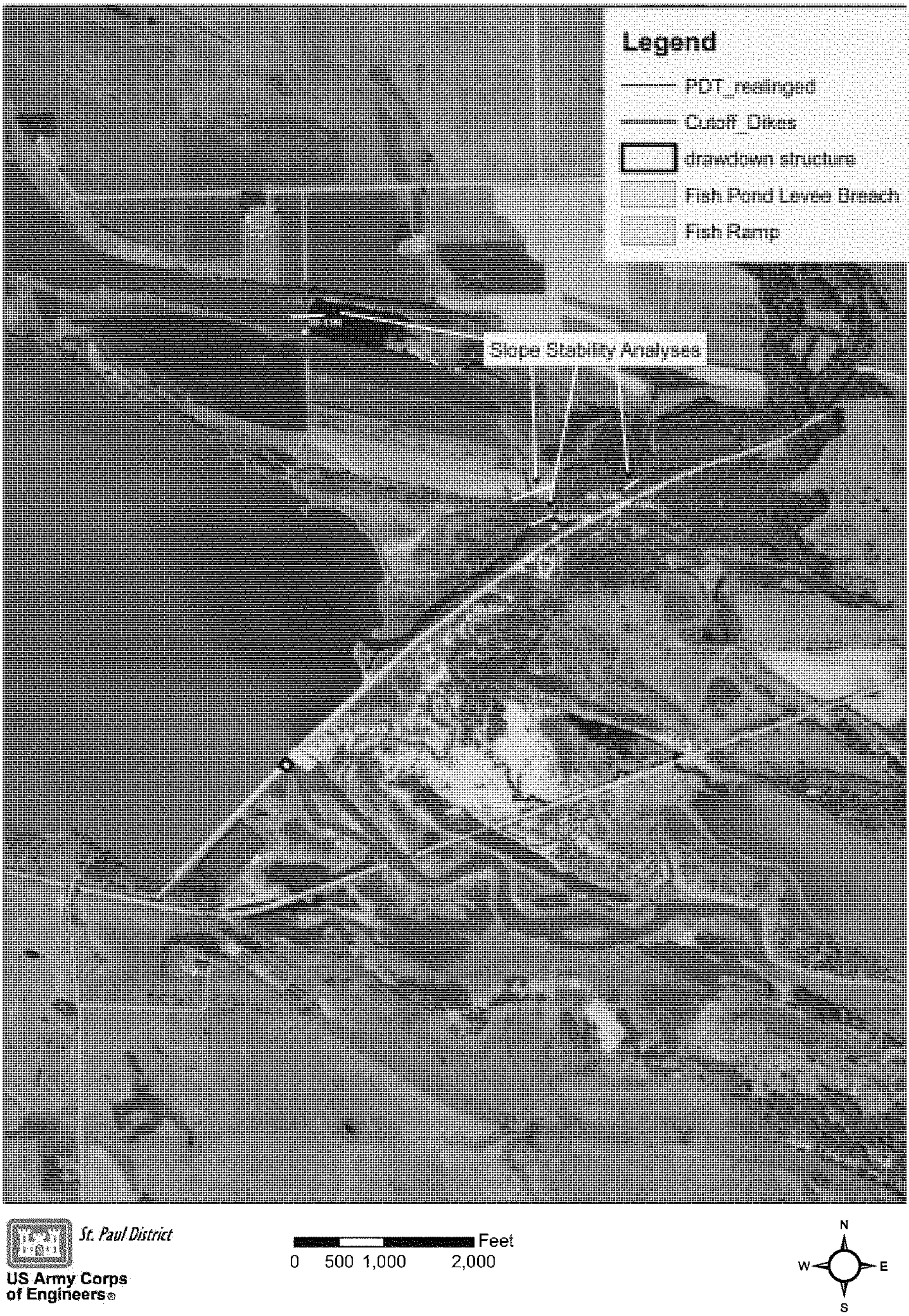


PLATE H-2

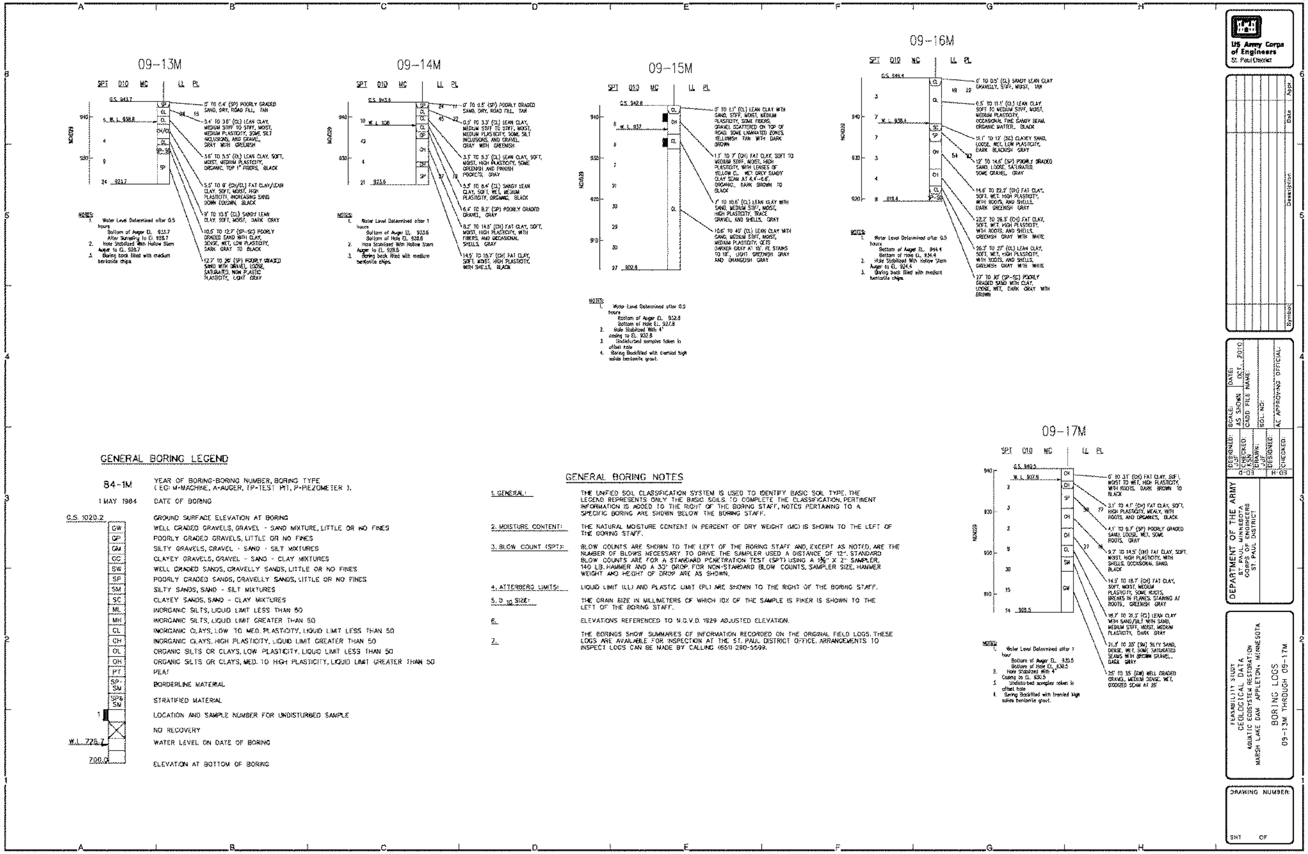
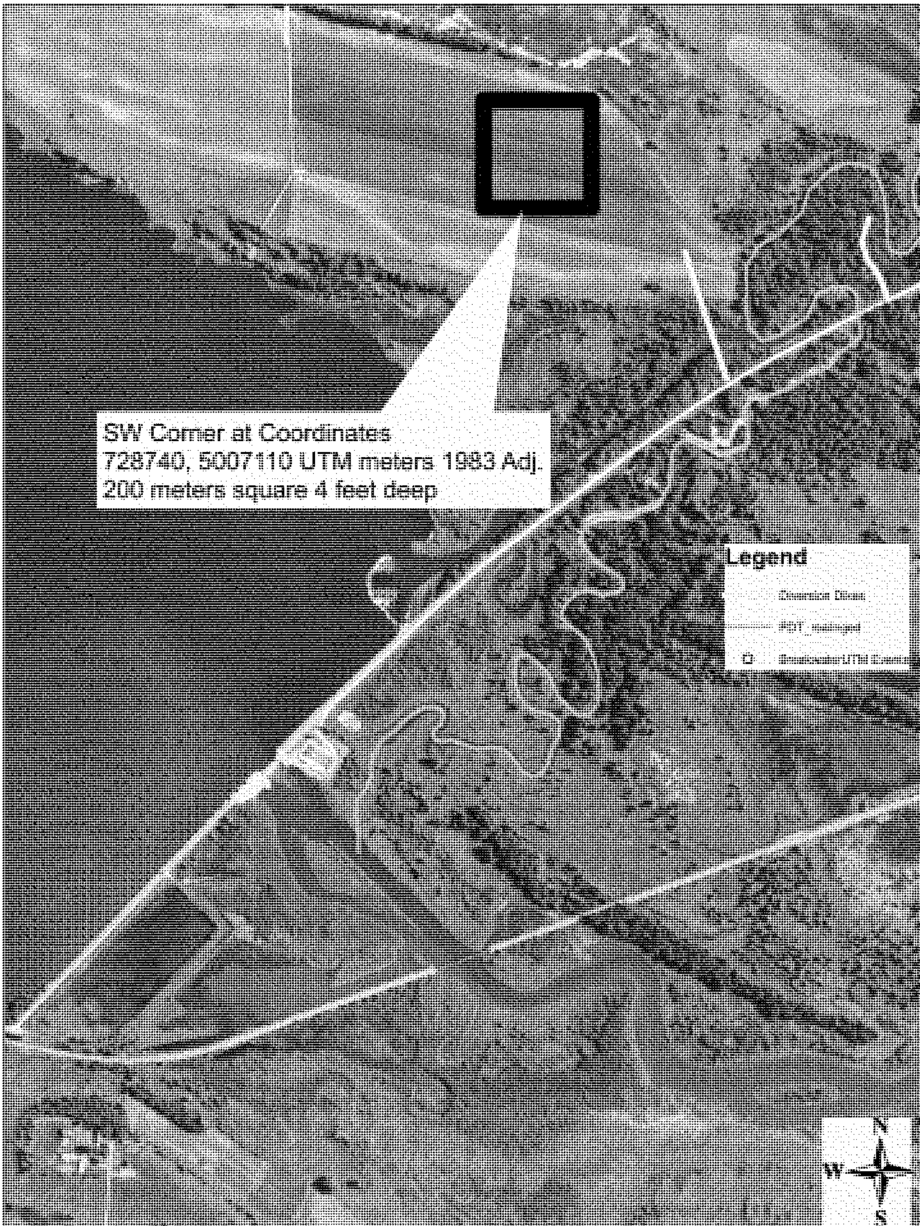

09-13M
09-14M
09-15M
09-16M
09-17M
SPT D10 MC LL PL
GENERAL BORING LEGEND
84-1M YEAR OF BORING-BORING NUMBER, BORING TYPE (EG: M-MACHINE, A-AUGER, TP-TEST PIT, P-PIEZOMETER).
1 MAY 1984 DATE OF BORING
G.S. 1020.2 GROUND SURFACE ELEVATION AT BORING
GW WELL GRADED GRAVELS, GRAVEL - SAND MIXTURE, LITTLE OR NO FINES
GP POORLY GRADED GRAVELS, LITTLE OR NO FINES
GM SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
GC CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
SW WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SP POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SM SILTY SANDS, SAND - SILT MIXTURES
SC CLAYEY SANDS, SAND - CLAY MIXTURES
ML INORGANIC SILTS, LIQUID LIMIT LESS THAN 50
MH INORGANIC SILTS, LIQUID LIMIT GREATER THAN 50
CL INORGANIC CLAYS, LOW TO MED. PLASTICITY, LIQUID LIMIT LESS THAN 50
CH INORGANIC CLAYS, HIGH PLASTICITY, LIQUID LIMIT GREATER THAN 50
OL ORGANIC SILTS OR CLAYS, LOW PLASTICITY, LIQUID LIMIT LESS THAN 50
OH ORGANIC SILTS OR CLAYS, MED. TO HIGH PLASTICITY, LIQUID LIMIT GREATER THAN 50
PT PEAT
SP-SM BORDERLINE MATERIAL
SP&SM STRATIFIED MATERIAL
1 LOCATION AND SAMPLE NUMBER FOR UNDISTURBED SAMPLE
NO RECOVERY
W.L. 725.7 WATER LEVEL ON DATE OF BORING
700.0 ELEVATION AT BOTTOM OF BORING
GENERAL BORING NOTES
1. GENERAL: THE UNIFIED SOIL CLASSIFICATION SYSTEM IS USED TO IDENTIFY BASIC SOIL TYPE. THE LEGEND REPRESENTS ONLY THE BASIC SOILS. TO COMPLETE THE CLASSIFICATION, PERTINENT INFORMATION IS ADDED TO THE RIGHT OF THE BORING STAFF, NOTES PERTAINING TO A SPECIFIC BORING ARE SHOWN BELOW THE BORING STAFF.
2. MOISTURE CONTENT: THE NATURAL MOISTURE CONTENT IN PERCENT OF DRY WEIGHT (MC) IS SHOWN TO THE LEFT OF THE BORING STAFF.
3. BLOW COUNT (SPT): BLOW COUNTS ARE SHOWN TO THE LEFT OF THE BORING STAFF AND, EXCEPT AS NOTED, ARE THE NUMBER OF BLOWS NECESSARY TO DRIVE THE SAMPLER USED A DISTANCE OF 12". STANDARD BLOW COUNTS ARE FOR A STANDARD PENETRATION TEST (SPT) USING A 1 3/8" X 2" SAMPLER, 140 LB. HAMMER AND A 30" DROP. FOR NON-STANDARD BLOW COUNTS, SAMPLER SIZE, HAMMER WEIGHT AND HEIGHT OF DROP ARE AS SHOWN.
4. ATTERBERG LIMITS: LIQUID LIMIT (LL) AND PLASTIC LIMIT (PL) ARE SHOWN TO THE RIGHT OF THE BORING STAFF.
5. D 10 SIZE: THE GRAIN SIZE IN MILLIMETERS OF WHICH 10% OF THE SAMPLE IS FINER IS SHOWN TO THE LEFT OF THE BORING STAFF.
6. ELEVATIONS REFERENCED TO N.G.V.D. 1929 ADJUSTED ELEVATION.
7. THE BORINGS SHOW SUMMARIES OF INFORMATION RECORDED ON THE ORIGINAL FIELD LOGS. THESE LOGS ARE AVAILABLE FOR INSPECTION AT THE ST. PAUL DISTRICT OFFICE. ARRANGEMENTS TO INSPECT LOGS CAN BE MADE BY CALLING (651) 290-5599.
US Army Corps of Engineers
St. Paul District
DEPARTMENT OF THE ARMY
ST. PAUL, MINNESOTA
CORPS OF ENGINEERS
ST. PAUL DISTRICT
SCALE: AS SHOWN
DATE: OCT. 2010
CADD FILE NAME:
SOL. NO:
AE APPROVING OFFICIAL:
FEASIBILITY STUDY
GEOLOGICAL DATA
AQUATIC ECOSYSTEM RESTORATION
MARSH LAKE DAM APPLETON, MINNESOTA
BORING LOGS
09-13M THROUGH 09-17M
DRAWING NUMBER:
SHT OF

PLATE H-3

Marsh Lake Dam: Borrow Location



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0 500 1,000 2,000 Feet

PLATE H-4

SET Job#: **7223**

Extrusion Log

Date: 10/7/2009

Project/Client: Marsh Lake: Stage 1

Boring #	Sample#	Depth(ft)	Recovery (in)		Soil Description
09-17MU	1	12-14	BE:	21	Top 11.5" Organic Clay with shells and shell fragments, a few roots and rootlets, black (OH)
			AE:	20.5	Bottom 9" Lean Clay with sand and a trace of gravel and organics
					a few roots and rootlets and shell fragments, gray (CL)
09-17MU	2	15-16.5	BE:	15.5	Top 9.5" Lean Clay with a trace of gravel, gray (CL)
				15.5	Bottom 6" Silty Clay with sand and a trace of gravel, gray (CL-ML) *see below
					* Bottom has less clay and more silt than top of sample

PLATE H-5

Atterberg Limit (Plasticity Index) (ASTM:D4318)

Job: 7223

Project/Client: Marsh Lake: Stage 1 /// USACE St. Paul Division   Date: 10/21/09

Sample Information & Classification

Boring #	09-13	09-14	09-15	09-15	09-16	09-16	09-17	09-17
Sample #	1	1	2	6	1	5	4	6
Depth (ft)	3-3.5	1-2	3-4	18-19	3-4	18-19	10-11	19-19.5
Type or BPF								
Soil Classification	Sandy Lean Clay (CL)	Sandy Lean Clay (CL)	Lean Clay w/sand and a trace of organic material (CL)	Sandy Lean Clay w/a little gravel (CL)	Organic Clay w/a few rootlets (OL)	Organic Clay w/a few shells and rootlets (OH)	Organic Clay w/a few shells and rootlets and a trace of sand (OH)	Lean Clay (CL)
Atterberg Limits								
Liquid Limit	27.6	23.7	46.6	27.5	49.1	54.3	58.6	27.1
Plastic Limit	14.9	11.3	21.5	12.7	22.3	22.6	27.2	16.4
Plasticity Index	12.7	12.4	25.1	14.8	26.8	31.7	31.4	10.7

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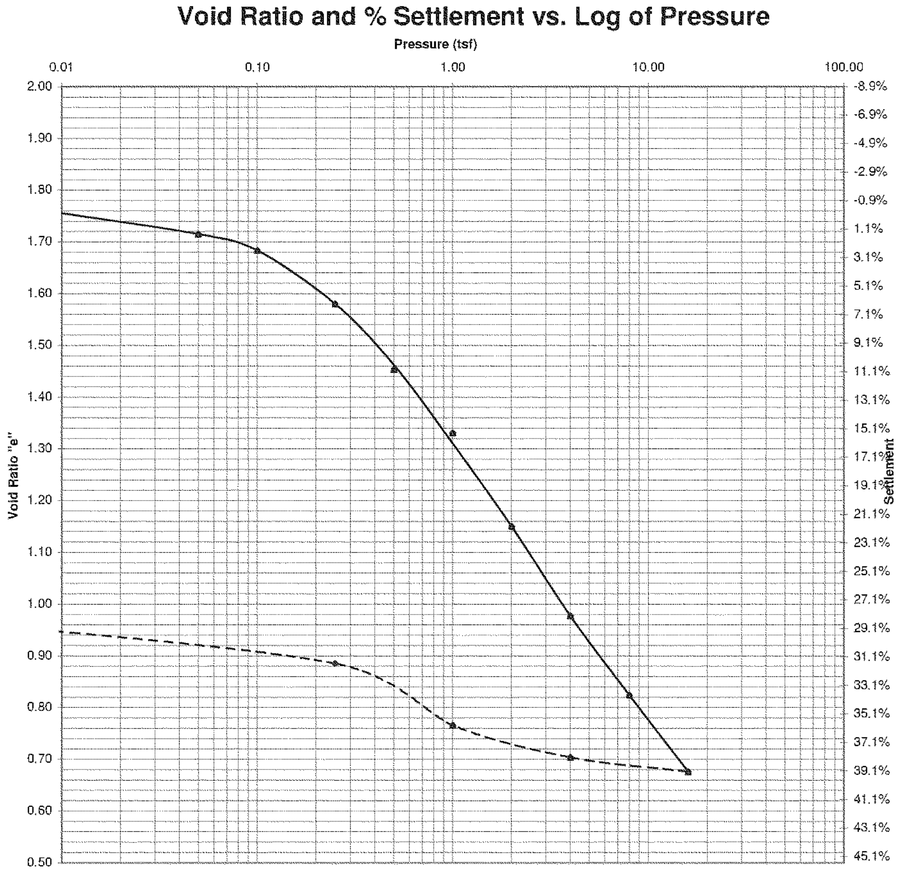
PLATE H-5



Project: Marsh Lake: Stage 1			Date: 10/21/09
Sample #: SN1	Boring #: 09-17MU	Depth ft: 12-14 (Top)	Job #: 7223
Soil Type: Organic Clay w/a trace of shell fragments (OH)			
Initial W/C (%): 68.0	Dry Density (pcf): 58.0	LL: 81.2 PL: 31.4 PI: 49.8	Gs: 2.56
Organic Content (%):	Initial Height (in.): 0.748	Diameter (in.): 2.506	e_o= 1.755
Preconsolidation Pressure (Pc): 0.23 tsf	Compression Index (Cc): 0.53	Recompression Index (Cr): ≅ 0.10	
Remarks:			

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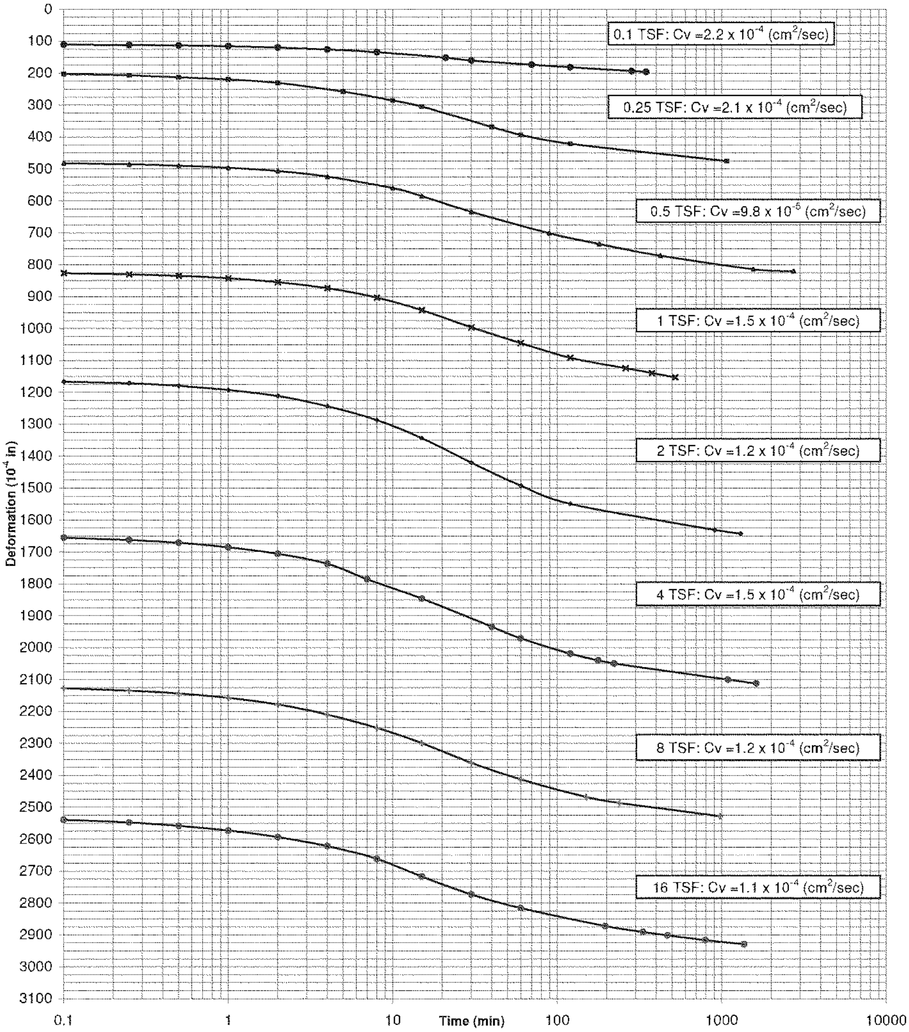
PLATE H-5

Consolidation Log of Time Curves



Project: Marsh Lake: Stage 1			Date: 10/21/09
Sample #: SN1	Boring #: 09-17MU	Depth ft: 12-14 (Top)	Job #: 7223

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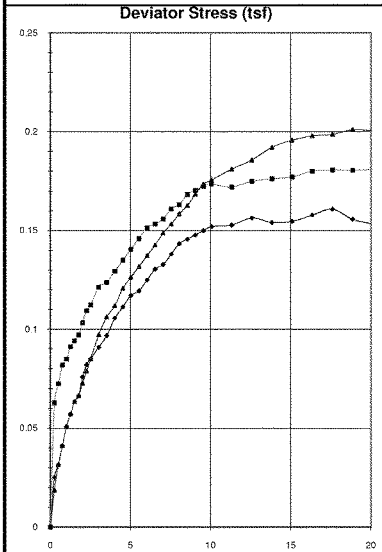
PLATE H-5

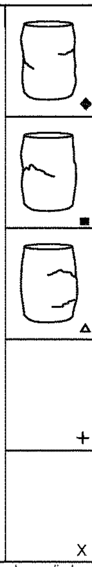
TRIAXIAL TEST ASTM: D 2850

Job No. 7223
Date: 10/13/09

Project: **Marsh Lake: Stage 1**
Boring #: **09-17MU** Sample #: **1** Type: **3T** Depth (ft): **12 - 14 (Mid-Top)**
Soil Type: **Organic Clay w/a Trace of Shell Fragments (OH)**

Deviator Stress (tsf)





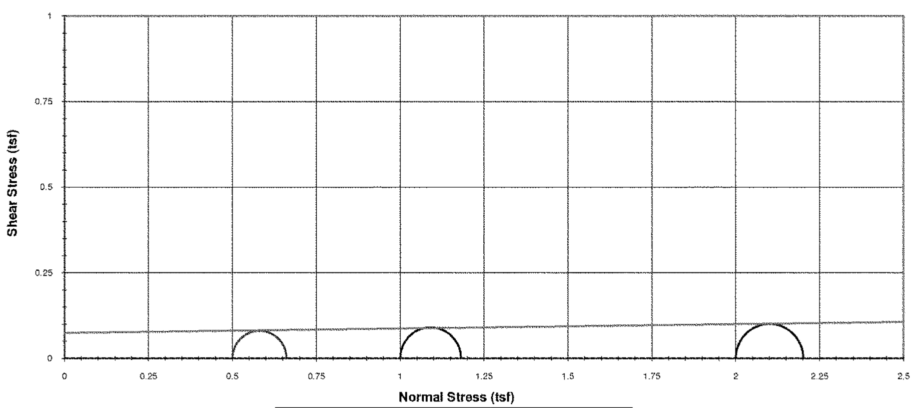
Failure Criterion: **Max. Deviator Stress**
Angle of internal friction, ϕ_u = 0.7 °
Apparent Cohesion, c_u = 0.07 (tsf)

Test Date:	10/7/09	Liquid Limit:	81.2
Test Type:	U-U	Plastic Limit:	31.4
Strain Rate (in/min):	0.05	Plasticity Index:	49.8
Strain Rate (%/min):	1.257	Spec. Gravity (Actual):	2.56

Before Consolidation	A	B	C	D	E
Diameter (in)	1.94	1.94	1.94		
Height (in)	3.98	3.98	3.98		
Water Content (%)	69.2	69.4	70.0		
Dry Density (pcf)	58.5	58.5	58.3		
Void Ratio	1.73	1.73	1.74		
After Consolidation					
Diameter (in)					
Height (in)					
Water Content (%)					
Dry Density (pcf)					
Void Ratio					
Back Pressure (tsf)					
Minor Principal Stress (tsf)	0.50	1.00	2.00		
Max. Deviator Stress (tsf)	0.16	0.18	0.20		
Ultimate Deviator Stress (tsf)	0.15	0.18	0.20		
Deviator Stress at Failure (tsf)	0.16	0.18	0.20		
Max. Pore Pressure Buildup (tsf)	--------	--------	--------		
Pore Pressure Parameter "B"	--------	--------	--------		
Pct. Axial Strain at Failure	17.6	20.1	18.9		

"These test results are for informational purposes only and must be reviewed by a qualified professional engineer to verify that the test parameters shown are appropriate for any particular design"

Remarks: Specimens trimmed to given sizes; Allowed to adjust under applied confining pressures for about 10 minutes.



Total ϕ_u: 0.7 ° c_u= 0.07 (tsf)

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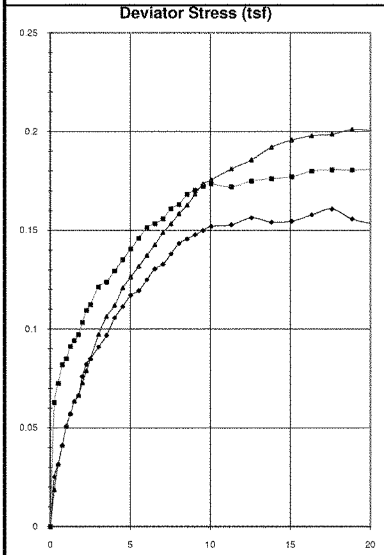
PLATE H-5

TRIAXIAL TEST ASTM: D 2850

Job No. **7223**
Date: **10/13/09**

Project: **Marsh Lake: Stage 1**
Boring #: **09-17MU** Sample #: **1** Type: **3T** Depth (ft): **12 - 14 (Mid-Top)**
Soil Type: **Organic Clay w/a Trace of Shell Fragments (OH)**



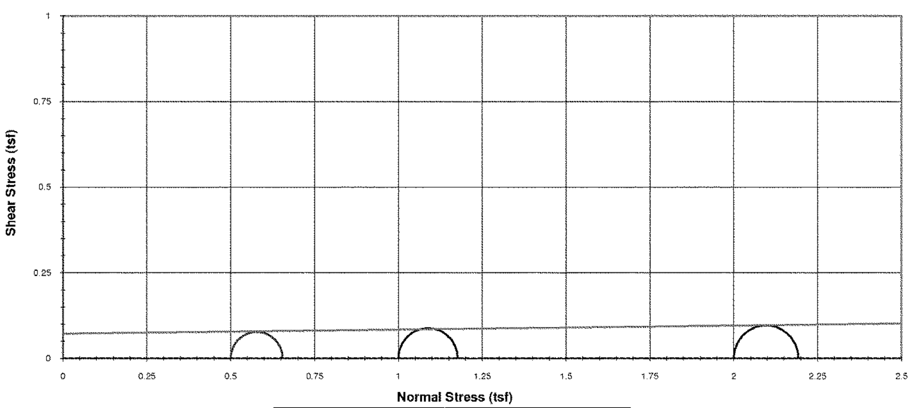
Failure Criterion: **Given Strain of: 15%**
Angle of internal friction, ϕ_u = **0.7 °**
Apparent Cohesion, c_u = **0.07 (tsf)**

Test Date:	10/7/09	Liquid Limit:	81.2
Test Type:	U-U	Plastic Limit:	31.4
Strain Rate (in/min):	0.05	Plasticity Index:	49.8
Strain Rate (%/min):	1.257	Spec. Gravity (Actual):	2.56

Before Consolidation	A	B	C	D	E
Diameter (in)	1.94	1.94	1.94		
Height (in)	3.98	3.98	3.98		
Water Content (%)	69.2	69.4	70.0		
Dry Density (pcf)	58.5	58.5	58.3		
Void Ratio	1.73	1.73	1.74		
After Consolidation					
Diameter (in)					
Height (in)					
Water Content (%)					
Dry Density (pcf)					
Void Ratio					
Back Pressure (tsf)					
Minor Principal Stress (tsf)	0.50	1.00	2.00		
Max. Deviator Stress (tsf)	0.16	0.18	0.20		
Ultimate Deviator Stress (tsf)	0.15	0.18	0.20		
Deviator Stress at Failure (tsf)	0.15	0.18	0.19		
Max. Pore Pressure Buildup (tsf)	--------	--------	--------		
Pore Pressure Parameter "B"	--------	--------	--------		
Pct. Axial Strain at Failure	15.0	15.0	15.0		

"These test results are for informational purposes only and must be reviewed by a qualified professional engineer to verify that the test parameters shown are appropriate for any particular design"

Remarks: Specimens trimmed to given sizes; Allowed to adjust under applied confining pressures for about 10 minutes.



Total ϕ_u:	0.7 °	c_u=	0.07	(tsf)

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PLATE H-5

Hydraulic Conductivity Test Data

Project: Marsh Lake: Stage 1 Date: 10/20/2009

Reported To: USACE -Geotech. & Geology Section Job No.: 7223

Boring:	09-17 MU						
Sample No.:	2						
Depth (ft.):	15 - 17 (Bot)						
Location:							
Sample Type:	5" TWT						
Soil Type:	Silty Clay (CL-ML)						
Atterberg Limits							
LL							
PL							
PI							
Permeability Test							
Before Test Conditions: Saturation %:							
Porosity:							
Ht. (in):	2.97						
Dia. (in):	2.88						
Dry Density (pcf):	106.7						
Water Content:	26.3%						
Test Type:	Falling						
Max Head (ft):	5.0						
Confining press. (Effective-psi):	6.9						
Trial No.:	12 - 16						
Water Temp ℃:	20.0						
% Compaction							
% Saturation (After Test)	98.0%						
Coefficient of Permeability							
K @ 20 ℃ (cm/sec)	**7.8×10^{-7}**						
K @ 20 ℃ (ft/min)	**1.5×10^{-6}**						
Notes:							

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PLATE H-5

Sheet 1 of 1

Borehole	Depth feet	Liquid Limit	Plastic Limit	Plasticity Index	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Organic Content (%)	Specific Gravity	Electrical Resistivity (ohm-cm)
09-15MU	8-10	47	16	31						2.638	

LAB SUMMARY GEO LAB BL-09-05055.GPJ BRAUN.GDT 12/7/09 12:19

Braun Project BL-09-05055
Marsh Lake: Stage 2
Marsh Lake

LABORATORY RESULTS SUMMARY

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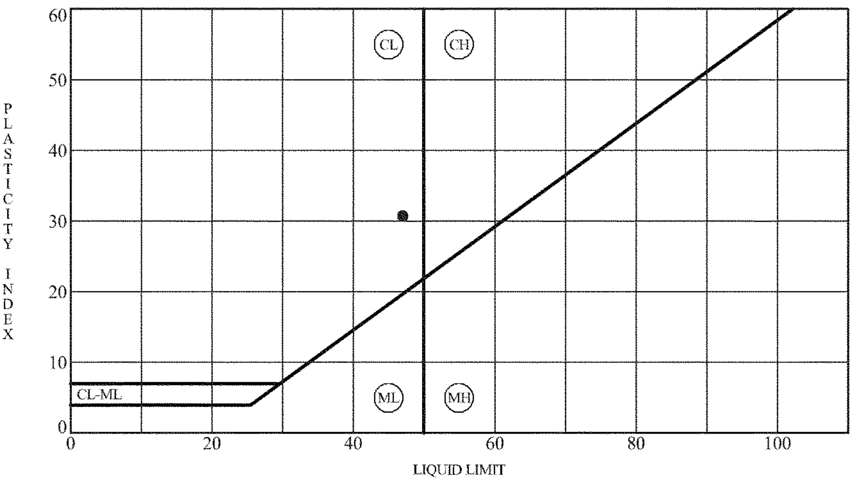


	Specimen Identification		LL	PL	PI	Fines	Classification
●	**09-15MU**	**8.0'-10.0'**	**47**	**16**	**31**		

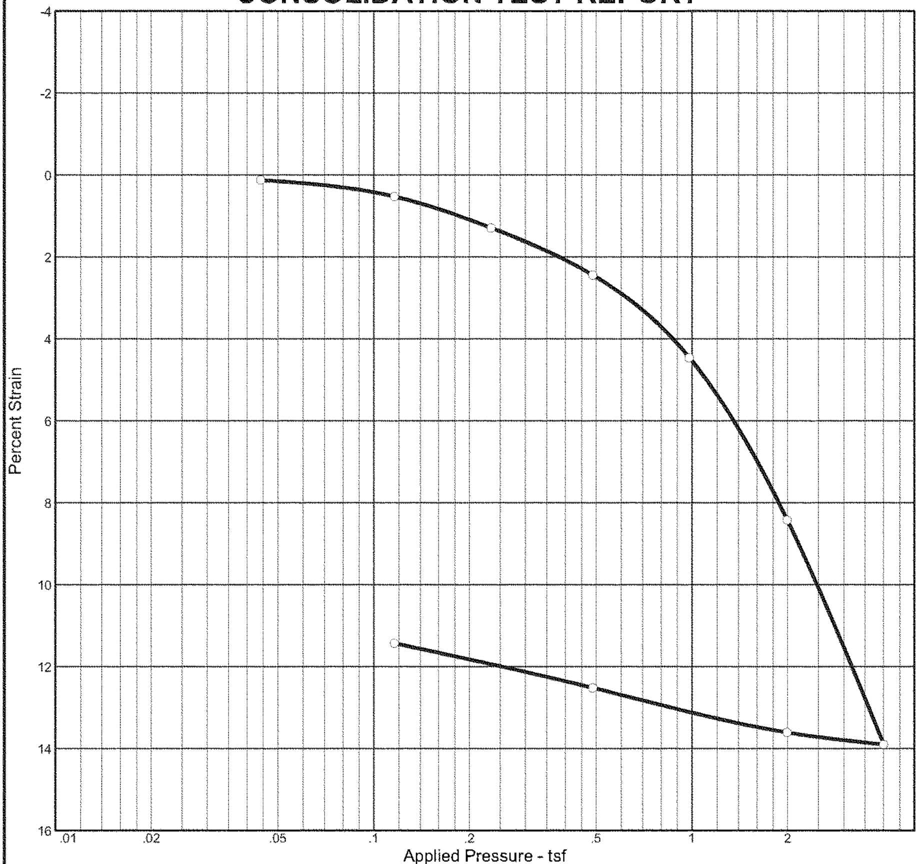
Braun Project BL-09-05055
Marsh Lake: Stage 2
Marsh Lake

ATTERBERG LIMITS RESULTS

BRAUN℠ INTERTEC

ATTERBERG LIMITS BL-09-05055.GPJ BRAUN.GDT 12/7/09 12:19

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Swell Press. (tsf)	Heave %	e_o
Sat.	Moist.											
89.4 %	34.7 %	81.3	47	31	2.638		1.27	0.37	0.03			1.025

MATERIAL DESCRIPTION	USCS	AASHTO
Organic Clay, black (OL)	OL	

Project No. BL-09-05055 **Client:** US Army Corps of Engineers

Project: Marsh Lake: Stage 2
Marsh Lake, MN

Location: Boring 09-15MU, #2, 8-10'

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Remarks:
ASTM D 2435

Figure 1

PLATE H-5

Dial Reading vs. Time

Project No.: BL-09-05055
Project: Marsh Lake: Stage 2
Marsh Lake, MN
Location: Boring 09-15MU, #2, 8-10'

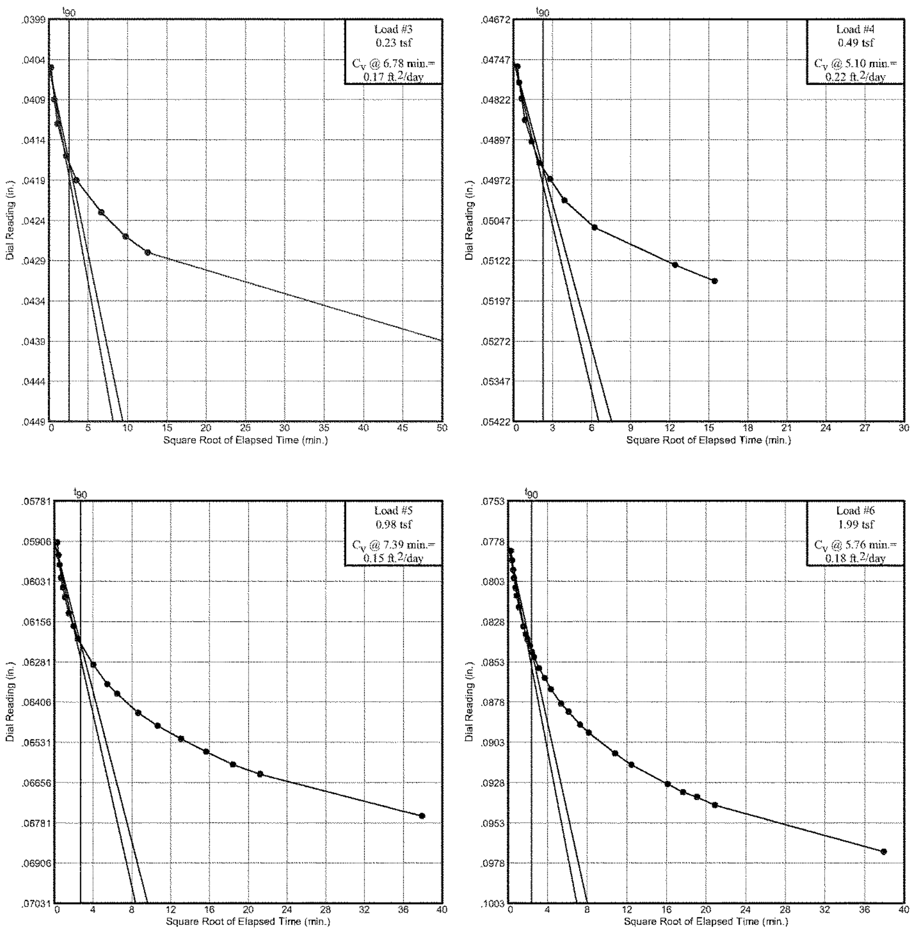

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Figure 2

PLATE H-5

Dial Reading vs. Time

Project No.: BL-09-05055
Project: Marsh Lake: Stage 2
Marsh Lake, MN
Location: Boring 09-15MU, #2, 8-10'

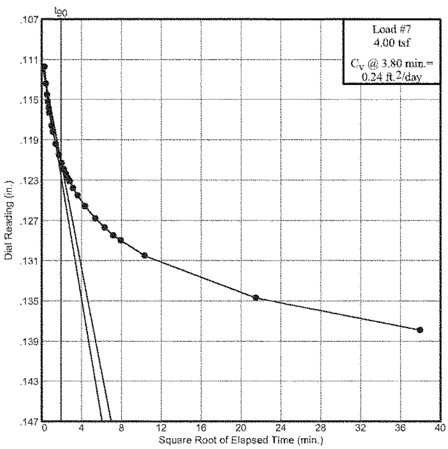

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Figure 3

PLATE H-5

CONSOLIDATION TEST DATA

Client: US Army Corps of Engineers
Project: Marsh Lake: Stage 2
Marsh Lake, MN
Project Number: BL-09-05055

Sample Data

Source:
Sample No.: #2
Elev. or Depth: 8-10' **Sample Length(in./cm.):**
Location: Boring 09-15MU, #2, 8-10'
Description: Organic Clay, black (OL)
Liquid Limit: 47 **Plasticity Index:** 31
USCS: OL **AASHTO:** **Figure No.:** 1
Testing Remarks: ASTM D 2435

Test Specimen Data

TOTAL SAMPLE	BEFORE TEST	AFTER TEST
Wet w+t = 142.80 g.	**Consolidometer #** = 4	**Wet w+t** = 121.65 g.
Dry w+t = 113.83 g.		**Dry w+t** = 99.40 g.
Tare Wt. = 30.42 g.	**Spec. Gravity** = 2.638	**Tare Wt.** = 30.83 g.
Height = .74 in.	**Height** = .74 in.	
Diameter = 2.49 in.	**Diameter** = 2.49 in.	
Weight = 104.68 g.	**Defl. Table** = #4-2008	
Moisture = 34.7 %	**Ht. Solids** = 0.3676 in.	**Moisture** = 32.4 %
Wet Den. = 109.6 pcf	**Dry Wt.** = 77.69 g.*	**Dry Wt.** = 68.57 g.
Dry Den. = 81.3 pcf	**Void Ratio** = 1.025	**Void Ratio** = 0.794
	Saturation = 89.4 %	

*** Initial dry weight used in calculations**

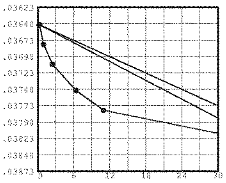
End-of-Load Summary

Pressure (tsf)	Final Dial (in.)	Machine Defl. (in.)	C_v (ft.^{2}/day)	C_α	Void Ratio	% Compression /Swell
start	0.03440				1.025	
0.04	0.03540	0.00010			1.023	0.1 Comprs.
0.12	0.03860	0.00030			1.015	0.5 Comprs.
0.23	0.04450	0.00050	0.17		0.999	1.3 Comprs.
0.49	0.05340	0.00080	0.22		0.976	2.4 Comprs.
0.98	0.06860	0.00100	0.15		0.935	4.5 Comprs.
1.99	0.09860	0.00150	0.18		0.855	8.4 Comprs.
4.00	0.13990	0.00200	0.24		0.744	13.9 Comprs.
1.99	0.13720	0.00150			0.750	13.6 Comprs.
0.49	0.12840	0.00080			0.772	12.5 Comprs.
0.12	0.11980	0.00030			0.794	11.4 Comprs.

C_c = 0.37 P_c = 1.27 tsf C_r = 0.03

Pressure: 0.12 tsf **TEST READINGS** **Load No. 2**

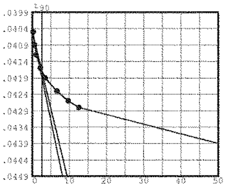
No.	Elapsed Time	Dial Reading
1	0.00	0.03540
2	0.10	0.03680
3	1.00	0.03710
4	6.00	0.03740
5	41.00	0.03780
6	120.00	0.03810
7	1445.00	0.03860



Void Ratio = 1.015 **Compression** = 0.5 %

Pressure: 0.23 tsf **TEST READINGS** **Load No. 3**

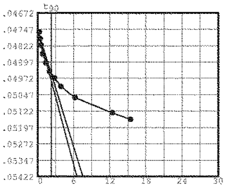
No.	Elapsed Time	Dial Reading
1	0.00	0.03860
2	0.10	0.04100
3	0.50	0.04140
4	1.25	0.04170
5	5.00	0.04210
6	12.50	0.04240
7	45.00	0.04280
8	95.50	0.04310
9	159.00	0.04330
10	2870.00	0.04450



Void Ratio = 0.999 **Compression** = 1.3 %
D_0 = 0.04046 D_{90} = 0.04169 D_{100} = 0.04182
C_v **at 6.8 min.** = 0.17 ft.^{2}/day

Pressure: 0.49 tsf **TEST READINGS** **Load No. 4**

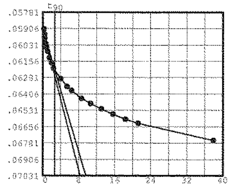
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.04450	11	154.50	0.05210
2	0.10	0.04840	12	239.00	0.05240
3	0.20	0.04870	13	601.00	0.05290
4	0.40	0.04900	14	1400.00	0.05340
5	0.80	0.04940			
6	2.00	0.04980			
7	4.00	0.05020			
8	8.00	0.05050			
9	15.30	0.05090			
10	39.00	0.05140			



Void Ratio = 0.976 **Compression** = 2.4 %
D_0 = 0.04747 D_{90} = 0.04949 D_{100} = 0.04972
C_v **at 5.1 min.** = 0.22 ft.^{2}/day

Pressure: 0.98 tsf — **TEST READINGS** — **Load No. 5**

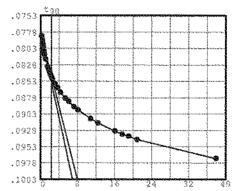
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.05340	11	16.30	0.06390
2	0.10	0.06010	12	30.00	0.06450
3	0.20	0.06050	13	42.30	0.06480
4	0.30	0.06080	14	75.00	0.06540
5	0.50	0.06120	15	114.00	0.06580
6	0.80	0.06150	16	171.00	0.06620
7	1.25	0.06180	17	245.00	0.06660
8	2.30	0.06230	18	340.00	0.06700
9	4.00	0.06270	19	451.00	0.06730
10	6.00	0.06310	20	1439.00	0.06860



Void Ratio = 0.935 **Compression** = 4.5 %
D_0 = 0.05907 D_{90} = 0.06224 D_{100} = 0.06259
C_v **at 7.4 min.** = 0.15 ft.^{2}/day

Pressure: 1.99 tsf — **TEST READINGS** — **Load No. 6**

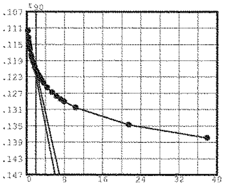
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.06860	15	10.00	0.08720
2	0.10	0.07990	16	14.00	0.08780
3	0.20	0.08050	17	19.00	0.08850
4	0.30	0.08110	18	29.00	0.08940
5	0.40	0.08160	19	37.50	0.08990
6	0.60	0.08220	20	53.00	0.09070
7	0.80	0.08270	21	66.50	0.09120
8	1.25	0.08340	22	117.50	0.09250
9	2.50	0.08460	23	155.50	0.09320
10	3.25	0.08510	24	260.50	0.09440
11	4.00	0.08540	25	313.00	0.09490
12	5.00	0.08580	26	365.00	0.09520
13	6.00	0.08620	27	437.00	0.09570
14	7.00	0.08650	28	1440.00	0.09860



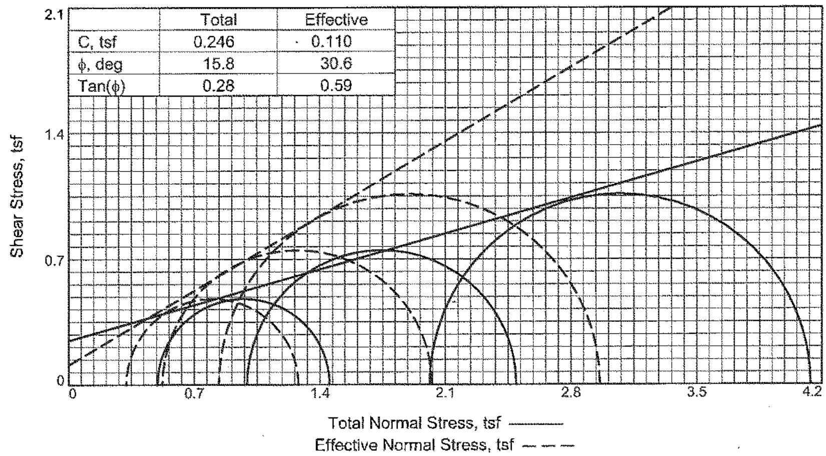
Void Ratio = 0.855 **Compression** = 8.4 %
D_0 = 0.07790 D_{90} = 0.08461 D_{100} = 0.08535
C_v **at 5.8 min.** = 0.18 ft.^{2}/day

Pressure: 4.00 tsf | TEST READINGS | Load No. 7

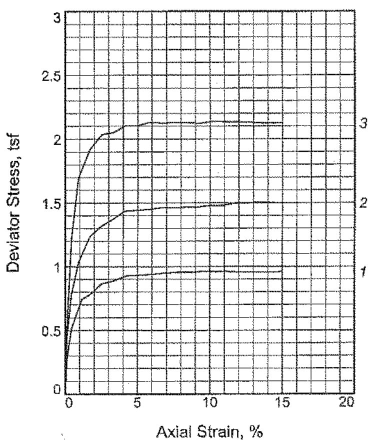
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.09860	14	6.00	0.12440
2	0.10	0.11370	15	7.00	0.12480
3	0.20	0.11540	16	8.00	0.12510
4	0.30	0.11650	17	10.00	0.12580
5	0.40	0.11720	18	13.00	0.12650
6	0.50	0.11780	19	19.00	0.12760
7	0.60	0.11830	20	29.00	0.12880
8	1.00	0.11960	21	40.00	0.12970
9	1.25	0.12020	22	52.00	0.13050
10	2.00	0.12140	23	63.00	0.13100
11	3.00	0.12250	24	107.00	0.13250
12	4.00	0.12330	25	462.00	0.13670
13	5.00	0.12390	26	1442.00	0.13990



Void Ratio = 0.744 Compression = 13.9 %
D_0 = 0.11112 D_{90} = 0.12115 D_{100} = 0.12227
C_v at 3.8 min. = 0.24 ft.^{2}/day



	Total	Effective
C, tsf	0.246	0.110
ϕ, deg	15.8	30.6
Tan(ϕ)	0.28	0.59



Sample No.		1	2	3
Initial	Water Content, %	33.9	31.9	31.9
	Dry Density, pcf	84.7	86.2	87.9
	Saturation, %	94.8	92.5	96.5
	Void Ratio	0.9445	0.9099	0.8728
	Diameter, in.	1.43	1.41	1.40
	Height, in.	2.78	2.82	2.82
At Test	Water Content, %	34.2	31.4	28.2
	Dry Density, pcf	86.6	90.0	94.4
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.9028	0.8295	0.7452
	Diameter, in.	1.42	1.39	1.37
	Height, in.	2.76	2.78	2.75
	Pore Pressure Parameter B	1.0	1.0	1.0
	Consolidation Pressure, tsf	0.50	1.00	2.01
	Back Pressure, tsf	6.64	6.14	5.13
	Cell Pressure, tsf	7.14	7.14	7.14
	Peak Deviator Stress, tsf	0.96	1.51	2.14
	Total Pore Pr., tsf	6.83	6.63	6.32
	Ultimate Deviator Stress, tsf	0.96	1.50	2.12
	Total Pore Pr., tsf	6.82	6.62	6.30
	Maj. Eff. Stress at Ultimate, tsf	1.28	2.02	2.96
	Min. Eff. Stress at Ultimate, tsf	0.31	0.51	0.83

Type of Test:
CU with Pore Pressures

Sample Type: Thinwall, 5", Bottom of sample

Description: Organic Clay, black (OL)

LL= 47 **PL=** 16 **PI=** 31

Assumed Specific Gravity= 2.638

Remarks: Rate of strain is 0.001 in/min. Failure criteria based on the ultimate stress which occurs at 15% strain. Samples were saturated for 10 days and consolidated for 3 days.

Figure CU Traix ASTM D 4767

Client: US Army Corps of Engineers

Project: Marsh Lake: Stage 2
Marsh Lake, MN

Sample Number: Boring 09-15MU, #2 **Depth:** 8-10'

Proj. No.: BL-09-05055 **Date Sampled:**

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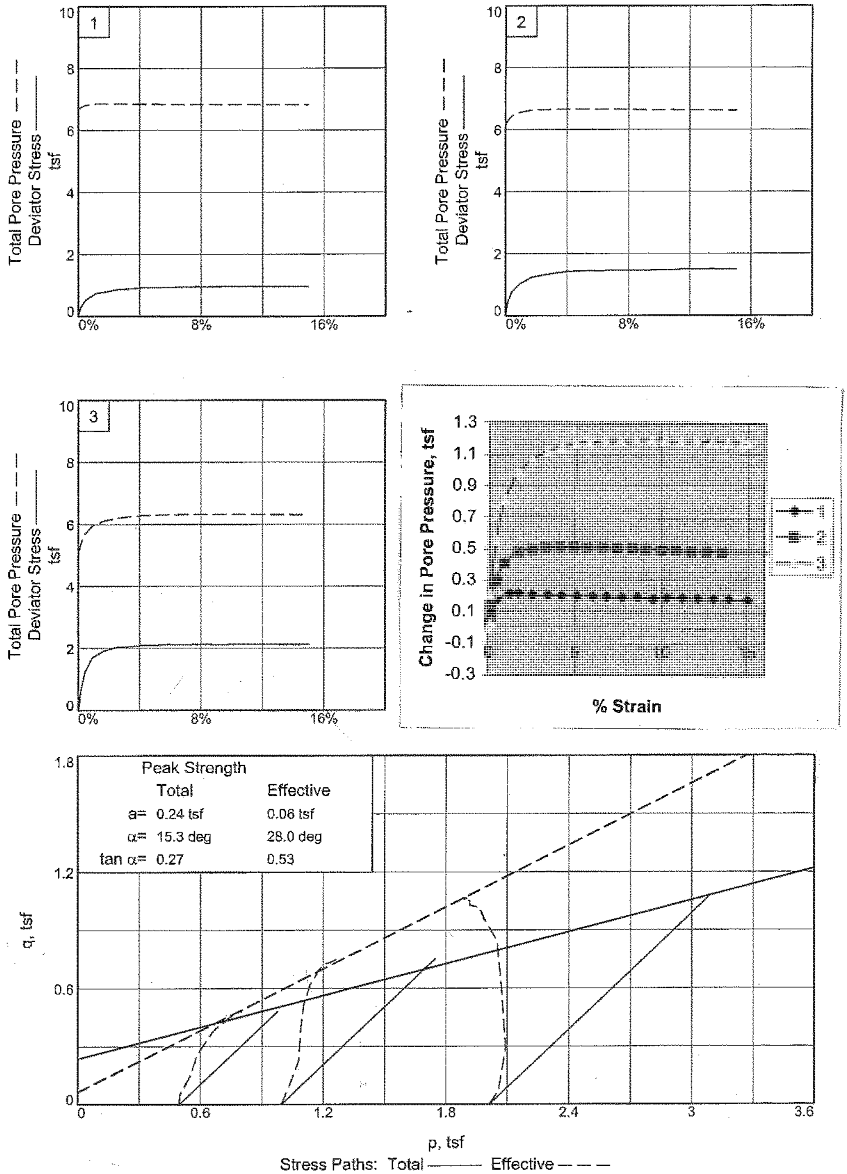
PLATE H-5



Client: US Army Corps of Engineers

Project: Marsh Lake: Stage 2

Depth: 8-10' **Sample Number:** Boring 09-15MU, #2

Project No.: BL-09-05055 **Figure** _______

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PLATE H-5

TRIAXIAL COMPRESSION TEST
CU with Pore Pressures

12/7/2009
12:11 PM

Date:
Client: US Army Corps of Engineers
Project: Marsh Lake: Stage 2
Marsh Lake, MN
Project No.: BL-09-05055
Depth: 8-10' **Sample Number:** Boring 09-15MU, #2
Description: Organic Clay, black (OL)
Remarks: Rate of strain is 0.001 in/min. Failure criteria based on the ultimate stress which occurs at 15% strain. Samples were saturated for 10 days and consolidated for 3 days.
Type of Sample: Thinwall, 5", Bottom of sample
Assumed Specific Gravity=2.638 **LL**=47 **PL**=16 **PI**=31
Test Method: COE uniform strain

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	101.950			161.490
Moisture content: Dry soil+tare, gms.	84.020			128.140
Moisture content: Tare, gms.	31.190			29.710
Moisture, %	33.9	35.8	34.2	33.9
Moist specimen weight, gms.	132.5			
Diameter, in.	1.43	1.43	1.42	
Area, in.^{2}	1.60	1.60	1.58	
Height, in.	2.78	2.78	2.76	
Net decrease in height, in.		0.00	0.02	
Wet Density, pcf	113.4	115.0	116.2	
Dry density, pcf	84.7	84.7	86.6	
Void ratio	0.9445	0.9445	0.9028	
Saturation, %	94.8	100.0	100.0	

Test Readings for Specimen No. 1

Consolidation cell pressure = 7.140 tsf
Consolidation back pressure = 6.644 tsf
Consolidation effective confining stress = 0.496 tsf
Peak Stress = 0.961 tsf **at reading no.** 14
Ult. Stress = 0.958 tsf **at reading no.** 20

Braun Intertec

PLATE H-5

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. tsf	P tsf	Q tsf
0	0.0131	19.740	0.0	0.0	0.000	0.496	0.496	1.00	6.644	0.496	0.000
1	0.0141	22.000	2.3	0.0	0.103	0.448	0.551	1.23	6.692	0.500	0.052
2	0.0171	26.120	6.4	0.1	0.291	0.403	0.694	1.72	6.737	0.548	0.145
3	0.0252	31.060	11.3	0.4	0.515	0.327	0.842	2.57	6.813	0.584	0.257
4	0.0449	36.220	16.5	1.2	0.744	0.284	1.028	3.62	6.856	0.656	0.372
5	0.0597	37.070	17.3	1.7	0.778	0.282	1.060	3.76	6.858	0.671	0.389
6	0.0827	39.150	19.4	2.5	0.864	0.291	1.155	3.97	6.849	0.723	0.432
7	0.1057	39.880	20.1	3.4	0.889	0.291	1.180	4.06	6.849	0.736	0.445
8	0.1296	40.920	21.2	4.2	0.927	0.295	1.222	4.14	6.845	0.758	0.463
9	0.1539	41.260	21.5	5.1	0.933	0.296	1.229	4.15	6.844	0.762	0.466
10	0.1783	41.570	21.8	6.0	0.937	0.299	1.236	4.14	6.841	0.768	0.469
11	0.2022	42.020	22.3	6.8	0.948	0.302	1.250	4.14	6.838	0.776	0.474
12	0.2271	42.400	22.7	7.7	0.955	0.305	1.260	4.13	6.835	0.782	0.477
13	0.2510	42.630	22.9	8.6	0.955	0.301	1.256	4.17	6.839	0.779	0.478
14	0.2749	42.990	23.3	9.5	0.961	0.315	1.276	4.05	6.825	0.796	0.481
15	0.2988	43.190	23.4	10.3	0.960	0.307	1.267	4.13	6.833	0.787	0.480
16	0.3228	43.420	23.7	11.2	0.960	0.309	1.269	4.11	6.831	0.789	0.480
17	0.3477	43.580	23.8	12.1	0.957	0.312	1.269	4.07	6.828	0.791	0.479
18	0.3725	43.810	24.1	13.0	0.956	0.314	1.270	4.05	6.826	0.792	0.478
19	0.3976	44.070	24.3	13.9	0.957	0.316	1.273	4.03	6.824	0.794	0.478
20	0.4265	44.400	24.7	15.0	0.958	0.322	1.280	3.97	6.818	0.801	0.479

Braun Intertec

PLATE H-5

Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	109.360			158.850
Moisture content: Dry soil+tare, gms.	90.220			128.690
Moisture content: Tare, gms.	30.230			29.970
Moisture, %	31.9	34.5	31.4	30.6
Moist specimen weight, gms.	130.9			
Diameter, in.	1.41	1.41	1.39	
Area, in.²	1.55	1.55	1.51	
Height, in.	2.82	2.82	2.78	
Net decrease in height, in.		0.00	0.04	
Wet Density, pcf	113.7	116.0	118.3	
Dry density, pcf	86.2	86.2	90.0	
Void ratio	0.9099	0.9099	0.8295	
Saturation, %	92.5	100.0	100.0	

Test Readings for Specimen No. 2

Consolidation cell pressure = 7.140 tsf

Consolidation back pressure = 6.145 tsf

Consolidation effective confining stress = 0.995 tsf

Peak Stress = 1.505 tsf **at reading no.** 19

Ult. Stress = 1.500 tsf **at reading no.** 21

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. tsf	P tsf	Q tsf
0	0.0092	19.520	0.0	0.0	0.000	0.995	0.995	1.00	6.145	0.995	0.000
1	0.0109	23.800	4.3	0.1	0.204	0.932	1.136	1.22	6.208	1.034	0.102
2	0.0130	29.050	9.5	0.1	0.454	0.853	1.307	1.53	6.287	1.080	0.227
3	0.0208	35.940	16.4	0.4	0.781	0.700	1.481	2.12	6.440	1.090	0.390
4	0.0349	41.380	21.9	0.9	1.034	0.588	1.622	2.76	6.552	1.105	0.517
5	0.0567	45.920	26.4	1.7	1.239	0.516	1.755	3.40	6.624	1.135	0.619
6	0.0789	47.850	28.3	2.5	1.318	0.501	1.819	3.63	6.639	1.160	0.659
7	0.1017	49.310	29.8	3.3	1.375	0.485	1.860	3.83	6.655	1.172	0.687
8	0.1233	50.860	31.3	4.1	1.435	0.481	1.916	3.98	6.659	1.198	0.717
9	0.1463	51.310	31.8	4.9	1.443	0.482	1.925	3.99	6.658	1.203	0.721
10	0.1692	51.710	32.2	5.7	1.448	0.486	1.934	3.98	6.654	1.210	0.724
11	0.1920	52.290	32.8	6.6	1.461	0.484	1.945	4.02	6.656	1.215	0.731
12	0.2162	52.610	33.1	7.4	1.462	0.489	1.951	3.99	6.651	1.220	0.731
13	0.2400	52.980	33.5	8.3	1.465	0.493	1.958	3.97	6.647	1.225	0.732
14	0.2629	53.320	33.8	9.1	1.466	0.499	1.965	3.94	6.641	1.232	0.733
15	0.2865	53.950	34.4	10.0	1.480	0.506	1.986	3.92	6.634	1.246	0.740
16	0.3108	54.240	34.7	10.8	1.478	0.502	1.980	3.94	6.638	1.241	0.739
17	0.3347	55.070	35.6	11.7	1.498	0.513	2.011	3.92	6.627	1.262	0.749
18	0.3596	55.420	35.9	12.6	1.498	0.512	2.010	3.93	6.628	1.261	0.749
19	0.3836	55.960	36.4	13.5	1.505	0.515	2.020	3.92	6.625	1.268	0.753
20	0.4076	56.210	36.7	14.3	1.501	0.520	2.021	3.89	6.620	1.270	0.750
21	0.4279	56.510	37.0	15.0	1.500	0.524	2.024	3.86	6.616	1.274	0.750

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PLATE H-5

Parameters for Specimen No. 3

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	100.010			159.530
Moisture content: Dry soil+tare, gms.	83.300			131.880
Moisture content: Tare, gms.	30.980			31.540
Moisture, %	31.9	33.1	28.2	27.6
Moist specimen weight, gms.	132.7			
Diameter, in.	1.40	1.40	1.37	
Area, in.^{2}	1.55	1.55	1.48	
Height, in.	2.82	2.82	2.75	
Net decrease in height, in.		0.00	0.07	
Wet Density, pcf	116.0	117.0	121.0	
Dry density, pcf	87.9	87.9	94.4	
Void ratio	0.8728	0.8728	0.7452	
Saturation, %	96.5	100.0	100.0	

Test Readings for Specimen No. 3

Consolidation cell pressure = 7.143 tsf
Consolidation back pressure = 5.131 tsf
Consolidation effective confining stress = 2.012 tsf
Peak Stress = 2.138 tsf **at reading no.** 15
Ult. Stress = 2.124 tsf **at reading no.** 21

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Eff. Stress tsf	Major Eff. Stress tsf	1:3 Ratio	Pore Press. tsf	P tsf	Q tsf
0	0.0099	18.700	0.0	0.0	0.000	2.012	2.012	1.00	5.131	2.012	0.000
1	0.0118	21.570	2.9	0.1	0.140	1.986	2.126	1.07	5.157	2.056	0.070
2	0.0139	30.600	11.9	0.1	0.580	1.802	2.382	1.32	5.341	2.092	0.290
3	0.0219	44.000	25.3	0.4	1.229	1.456	2.685	1.84	5.687	2.071	0.615
4	0.0348	53.710	35.0	0.9	1.693	1.203	2.896	2.41	5.940	2.049	0.846
5	0.0566	58.680	40.0	1.7	1.918	1.027	2.945	2.87	6.116	1.986	0.959
6	0.0796	61.500	42.8	2.5	2.035	0.946	2.981	3.15	6.197	1.964	1.018
7	0.1022	62.230	43.5	3.4	2.053	0.890	2.943	3.31	6.253	1.916	1.026
8	0.1245	63.720	45.0	4.2	2.105	0.863	2.968	3.44	6.280	1.916	1.053
9	0.1474	64.140	45.4	5.0	2.106	0.841	2.947	3.50	6.302	1.894	1.053
10	0.1702	65.080	46.4	5.8	2.131	0.834	2.965	3.56	6.309	1.900	1.066
11	0.1940	65.370	46.7	6.7	2.125	0.825	2.950	3.58	6.318	1.887	1.062
12	0.2189	65.910	47.2	7.6	2.128	0.823	2.951	3.59	6.320	1.887	1.064
13	0.2438	66.360	47.7	8.5	2.128	0.825	2.953	3.58	6.318	1.889	1.064
14	0.2679	66.740	48.0	9.4	2.124	0.820	2.944	3.59	6.323	1.882	1.062
15	0.2917	67.530	48.8	10.2	2.138	0.825	2.963	3.59	6.318	1.894	1.069
16	0.3159	67.890	49.2	11.1	2.133	0.824	2.957	3.59	6.319	1.891	1.067
17	0.3406	68.420	49.7	12.0	2.134	0.822	2.956	3.60	6.321	1.889	1.067
18	0.3655	68.790	50.1	12.9	2.128	0.832	2.960	3.56	6.311	1.896	1.064
19	0.3905	69.210	50.5	13.8	2.124	0.833	2.957	3.55	6.310	1.895	1.062
20	0.4144	69.730	51.0	14.7	2.124	0.836	2.960	3.54	6.307	1.898	1.062
21	0.4234	69.930	51.2	15.0	2.124	0.838	2.962	3.53	6.305	1.900	1.062

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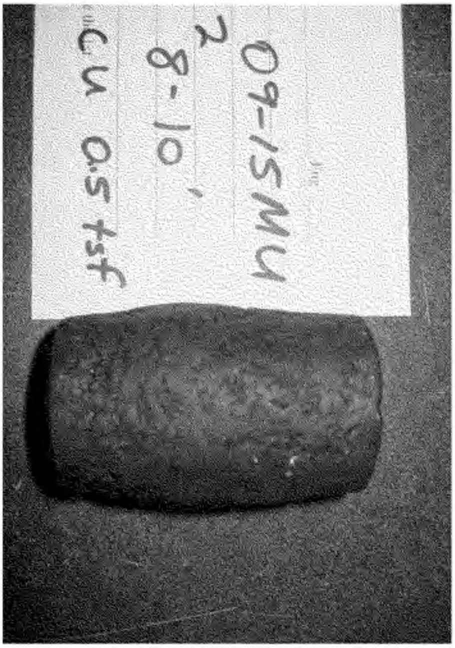
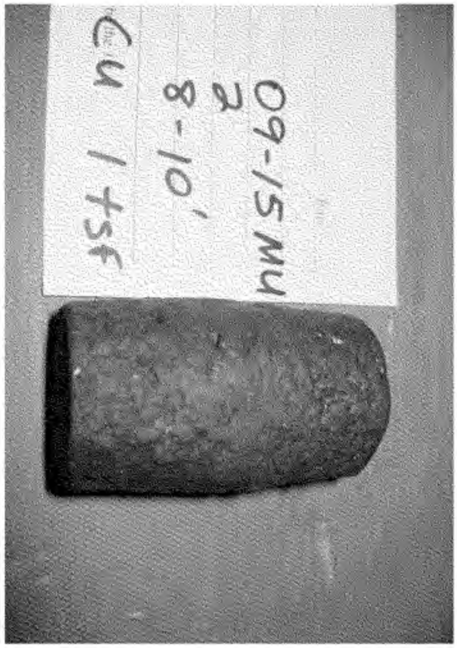
PLATE H-5





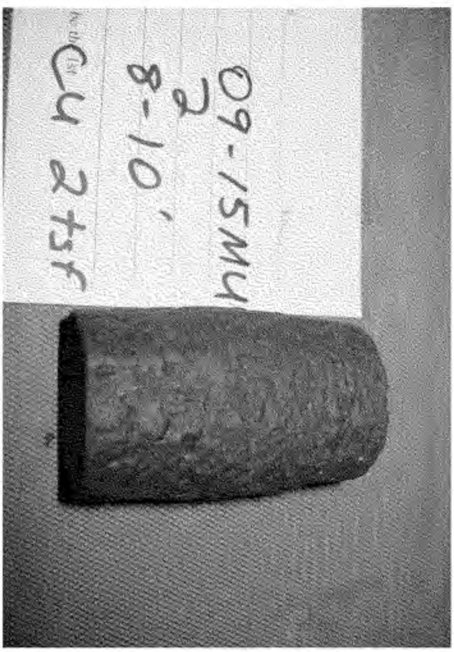


PLATE H-5

CSETT INPUT

```
100 TITLE
110 Marsh Lake: The diversion dike A: Thalweg Case
120 2DSO 1 6 0 0.5 125
130 -9999 936
140 1119 936
150 1189.4 953.6
160 1199.4 953.6
170 1269.8 936
180 9999 936
190 SOIL 1 936 N 100
200 SOIL 2 930.4 D 40 0.03 62 0.32
210 INDEX 0.53 600 1.755
220 SOIL 3 918.8 N 34
240 BOUS 80
250 TIMI 0.0192 2
260 OUTPUT 1144.4 1194.4 5
270 END
```

```
100 TITLE
110 Marsh Lake: The diversion dike A: Overbank Case
120 2DSO 1 6 0 0.5 125
130 -9999 940.
140 1119 940.
150 1173.4 953.6
160 1183.4 953.6
170 1237.8 940.
180 9999 940.
190 SOIL 1 940.5 D 100 0.1 7 0.32
200 INDEX 0.53 100 1.755
210 SOIL 2 936.4 N 40
220 SOIL 3 930.6 D 34 0.1 7 0.32
230 INDEX 0.53 600 1.755
240 SOIL 4 919.2 N 35
260 BOUS 80
270 TIMI 0.0192 2
280 OUTPUT 1118.4 1178.4 5
290 END
```

PLATE H-6

CSETT INPUT

```
100 TITLE
110 Marsh Lake: Initial Highway embankment Load only
120 2DSO 1 8 0 0.5 125
130 -9999 939
140 1136.6 939
150 1168 939
160 1183 944
170 1218 944
180 1223 939
190 1254.4 939
200 9999 939
210 SOIL 1 939 S 50 0.1 11 0.32
220 INDEX 0.53 138 1.755
230 SOIL 2 932.1 S 40 0.03 11 0.32
240 INDEX 0.37 550 1.025
250 SOIL 3 927.9 N 60
280 BOUS 80
290 TIMS 0.5 1 5 10 50
300 OUTPUT 1135.5 1195.5 5
310 END
```

```
100 TITLE
110 Marsh Lake: Both the Initial Highway embankment and the proposed road raise
120 2DSO 1 8 0 0.5 125
130 -9999 939
140 1136.6 939
150 1168 939
160 1223 952.75
170 1248 952.75
180 1303 939
190 1325 939
200 9999 939
210 SOIL 1 939 S 50 0.1 11 0.32
220 INDEX 0.53 138 1.755
230 SOIL 2 932.1 S 40 0.03 11 0.32
240 INDEX 0.37 550 1.025
250 SOIL 3 927.9 N 60
270 BOUS 80
280 TIMI 0.0192 2
290 OUTPUT 1135.5 1235.5 5
300 END
```

PLATE H-6

CSETT Settlement

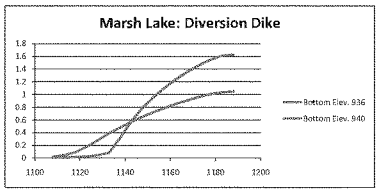
II. OUTPUT SUMMARY.

TITLE- Marsh Lake Diversion Dike: Bottom at 936.0

TIME (YR)	X=1108.0 1108	X=1113.0 1113	X=1118.0 1118	X=1123.0 1123	X=1128.0 1128	X=1133.0 1133	X=1138.0 1138	X=1143.0 1143	X=1148.0 1148	X=1153.0 1153	X=1158.0 1158	X=1163.0 1163	X=1168.0 1168	X=1173.0 1173	X=1178.0 1178	X=1183.0 1183	X=1188.0 1188
ULT.	0.024	0.045	0.092	0.177	0.283	0.388	0.484	0.573	0.654	0.728	0.795	0.858	0.913	0.965	1.007	1.035	1.047
0.5	0.018	0.034	0.068	0.132	0.211	0.288	0.361	0.427	0.486	0.54	0.591	0.637	0.68	0.717	0.75	0.771	0.779
1	0.024	0.045	0.092	0.176	0.279	0.383	0.478	0.567	0.646	0.718	0.785	0.847	0.904	0.954	0.996	1.024	1.034
5	0.024	0.045	0.092	0.177	0.283	0.388	0.484	0.573	0.654	0.728	0.795	0.858	0.913	0.965	1.007	1.035	1.047
10	0.024	0.045	0.092	0.177	0.283	0.388	0.484	0.573	0.654	0.728	0.795	0.858	0.913	0.965	1.007	1.035	1.047
50	0.024	0.045	0.092	0.177	0.283	0.388	0.484	0.573	0.654	0.728	0.795	0.858	0.913	0.965	1.007	1.035	1.047

TITLE- Marsh Lake Diversion Dike: Bottom at 940.0

TIME (YR)	X=1108.0	X=1113.0	X=1118.0	X=1123.0	X=1128.0	X=1133.0	X=1138.0	X=1143.0	X=1148.0	X=1153.0	X=1158.0	X=1163.0	X=1168.0	X=1173.0	X=1178.0	X=1183.0	X=1188.0
ULT.	0.007	0.01	0.016	0.026	0.045	0.085	0.33	0.592	0.799	0.97	1.118	1.249	1.364	1.466	1.551	1.614	1.627
0.5	0.006	0.008	0.012	0.02	0.034	0.066	0.289	0.526	0.708	0.858	0.985	1.097	1.196	1.283	1.357	1.412	1.423
1	0.007	0.01	0.016	0.026	0.045	0.084	0.329	0.591	0.795	0.966	1.113	1.244	1-Jan-00	1.459	1.543	1.606	1.62
5	0.007	0.01	0.016	0.026	0.045	0.085	0.33	0.592	0.799	0.97	1.118	1.249	1.364	1.466	1.551	1.614	1.627
10	0.007	0.01	0.016	0.026	0.045	0.085	0.33	0.592	0.799	0.97	1.118	1.249	1.364	1.466	1.551	1.614	1.627
50	0.007	0.01	0.016	0.026	0.045	0.085	0.33	0.592	0.799	0.97	1.118	1.249	1.364	1.466	1.551	1.614	1.627



II. OUTPUT SUMMARY.

TITLE- Marsh Lake existing road raise: Existing road profile

TIME (YR)	X=1135.5	X=1140.5	X=1145.5	X=1150.5	X=1155.5	X=1160.5	X=1165.5	X=1170.5	X=1175.5	X=1180.5	X=1185.5	X=1190.5	X=1195.5
ULT.	0.012	0.014	0.015	0.028	0.035	0.05	0.083	0.235	0.393	0.499	0.56	0.58	0.583
0.5	0	0	0	0	0.001	0.007	0.023	0.085	0.15	0.194	0.218	0.224	0.225
1	0	0	0	0.006	0.017	0.022	0.036	0.147	0.259	0.335	0.374	0.384	0.386
5	0.01	0.012	0.014	0.017	0.028	0.039	0.069	0.215	0.365	0.468	0.523	0.541	0.544
10	0.011	0.013	0.015	0.023	0.035	0.048	0.078	0.229	0.385	0.491	0.549	0.567	0.573
50	0.012	0.014	0.015	0.028	0.035	0.05	0.083	0.235	0.393	0.499	0.56	0.58	0.583

TITLE- Marsh Lake existing road raise: Raised road profile

TIME (YR)	X=1135.5	X=1140.5	X=1145.5	X=1150.5	X=1155.5	X=1160.5	X=1165.5	X=1170.5	X=1175.5	X=1180.5	X=1185.5	X=1190.5	X=1195.5
ULT.	0.114	0.274	0.413	0.52	0.624	0.732	0.851	0.965	1.063	1.14	1.186	1.199	1.202
0.5	0.03	0.093	0.147	0.188	0.226	0.268	0.315	0.361	0.4	0.433	0.451	0.454	0.454
1	0.052	0.164	0.258	0.328	0.393	0.466	0.546	0.623	0.691	0.748	0.778	0.785	0.785
5	0.095	0.247	0.375	0.476	0.569	0.674	0.781	0.889	0.981	1.06	1.099	1.11	1.113
10	0.11	0.267	0.402	0.509	0.607	0.715	0.829	0.943	1.038	1.118	1.162	1.173	1.174
50	0.114	0.274	0.413	0.52	0.624	0.732	0.851	0.965	1.063	1.14	1.186	1.199	1.202

TITLE- Marsh Lake existing road raise: Raised road profile minus existing road profile

TIME (YR)	X=1135.5 1135.5	X=1140.5 1140.5	X=1145.5 1145.5	X=1150.5 1150.5	X=1155.5 1155.5	X=1160.5 1160.5	X=1165.5 1165.5	X=1170.5 1170.5	X=1175.5 1175.5	X=1180.5 1180.5	X=1185.5 1185.5	X=1190.5 1190.5	X=1195.5 1195.5
ULT.	0.102	0.26	0.398	0.492	0.589	0.682	0.768	0.73	0.67	0.641	0.626	0.619	0.619
0.5	0.03	0.093	0.147	0.188	0.225	0.261	0.292	0.276	0.25	0.239	0.233	0.23	0.229
1	0.052	0.164	0.258	0.322	0.376	0.444	0.51	0.476	0.432	0.413	0.404	0.401	0.399
5	0.085	0.235	0.361	0.459	0.541	0.635	0.712	0.674	0.616	0.592	0.576	0.569	0.569
10	0.099	0.254	0.387	0.486	0.572	0.667	0.751	0.714	0.653	0.627	0.613	0.606	0.601
50	0.102	0.26	0.398	0.492	0.589	0.682	0.768	0.73	0.67	0.641	0.626	0.619	0.619

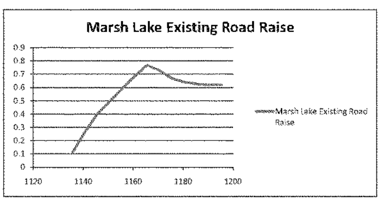
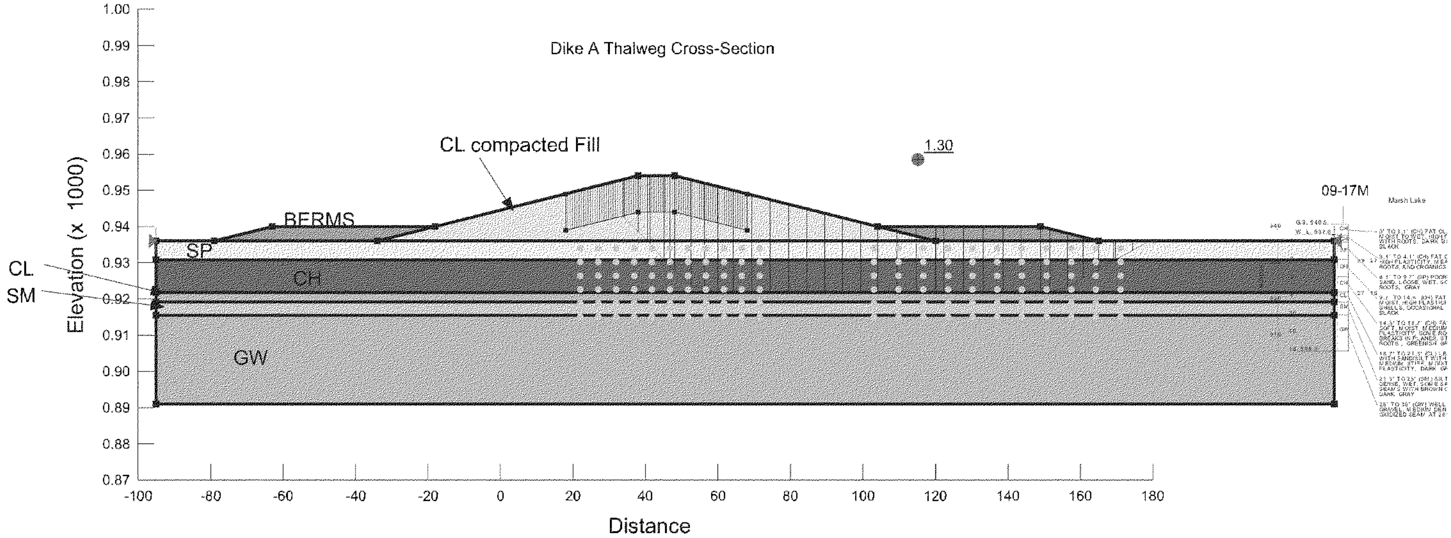


PLATE H-7

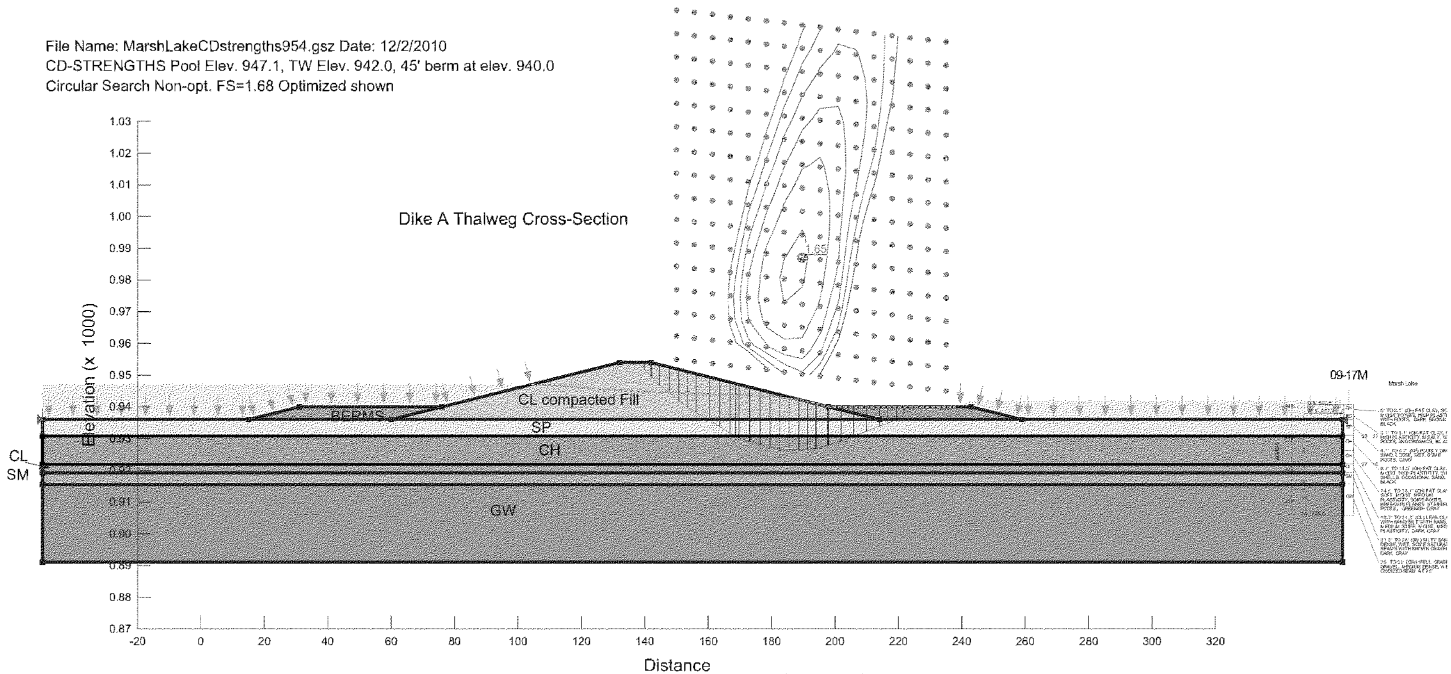
File Name: MarshLakeUUstrengthsCLtop954.gsz Date: 12/2/2010
UU-STRENGTHS 10' Crack filled with water with 45 foot berm at elev. 940.0
Non-Circular Search Non-opt. FS=1.38 Optimized Shown



CH Multiple Trial: 97 pcf Multiple Trial: 180 psf
SP Multiple Trial: 125 pcf 0 psf Multiple Trial: 30 °
SM Multiple Trial: 105 pcf 0 psf 33 °
GW Multiple Trial: 130 pcf 0 psf Multiple Trial: 30 °
CL compacted Fill Multiple Trial: 120 pcf Multiple Trial: 1300 psf
BERMS 100 pcf 300 psf
CL 97 pcf 840 psf

PLATE H-8

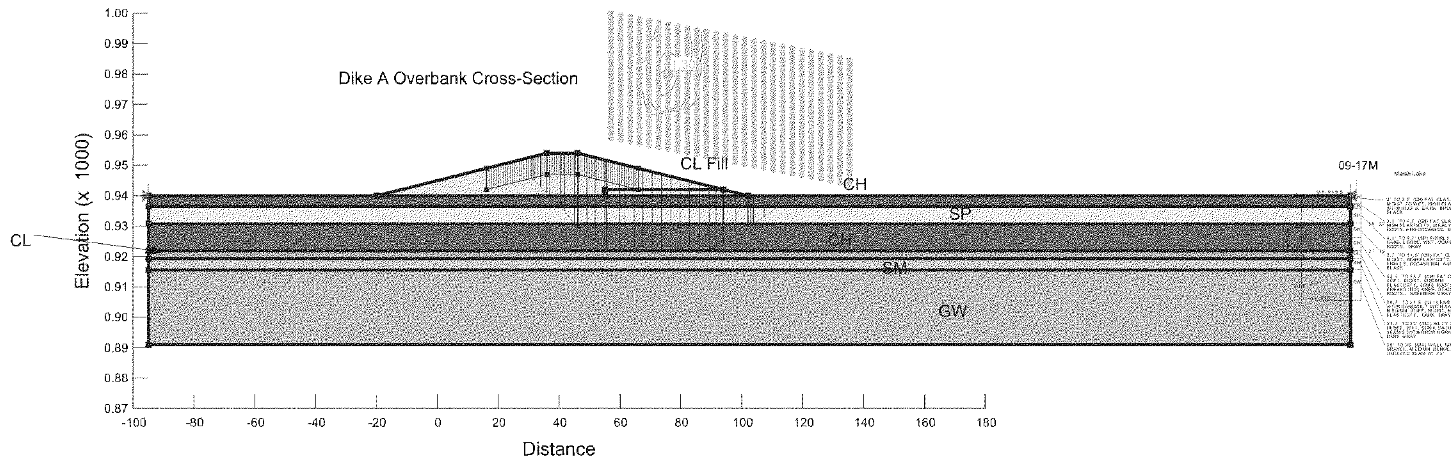
File Name: MarshLakeCDstrengths954.gsz Date: 12/2/2010
CD-STRENGTHS Pool Elev. 947.1, TW Elev. 942.0, 45' berm at elev. 940.0
Circular Search Non-opt. FS=1.68 Optimized shown



Name: CH Unit Weight: Multiple Trial: 97 pcf Cohesion: Multiple Trial: 0 psf Phi: 25 °
Name: SP Unit Weight: Multiple Trial: 125 pcf Cohesion: 0 psf Phi: Multiple Trial: 30 °
Name: SM Unit Weight: Multiple Trial: 130 pcf Cohesion: 0 psf Phi: 33 °
Name: GW Unit Weight: Multiple Trial: 130 pcf Cohesion: 0 psf Phi: Multiple Trial: 30 °
Name: CL compacted Fill Unit Weight: Multiple Trial: 120 pcf Cohesion: Multiple Trial: 0 psf Phi: 25 °
Name: BERMS Unit Weight: 100 pcf Cohesion: 300 psf Phi: 0 °
Name: CL Unit Weight: 100 pcf Cohesion: 200 psf Phi: 30 °

PLATE H-8

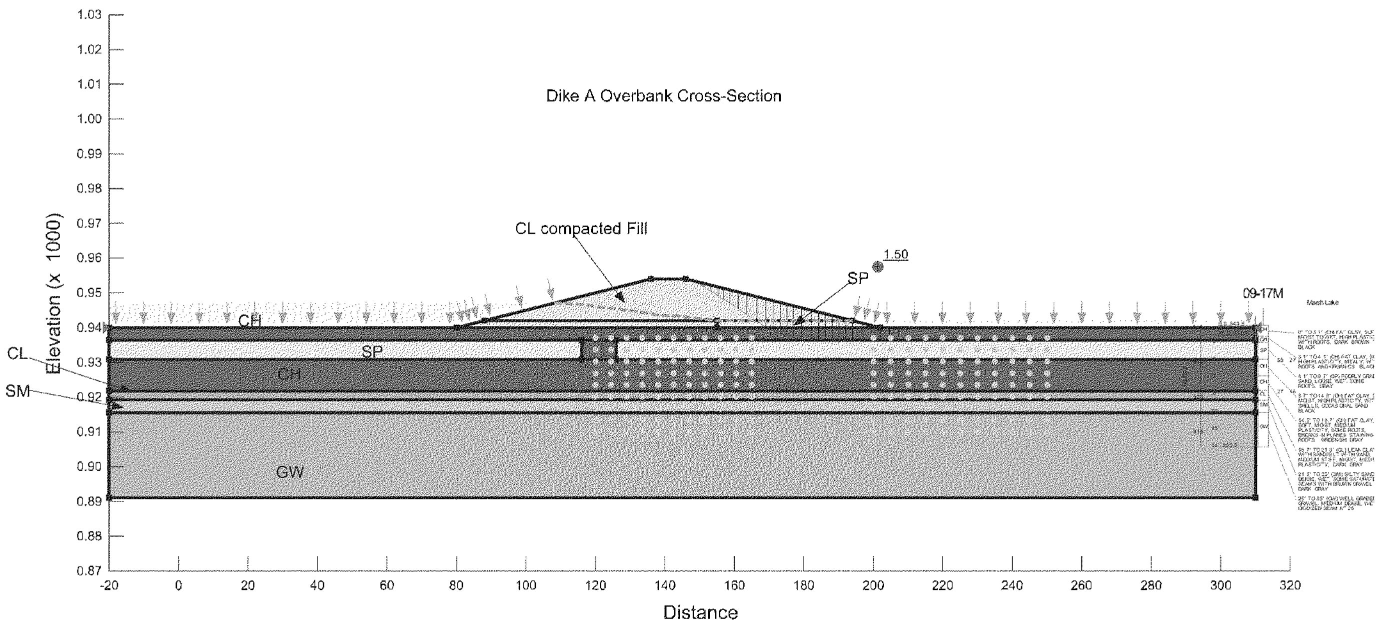
File Name: MarshLakeUUstrengthstop954Bottom940.gsz Date: 12/2/2010
UU-STRENGTHS 7' Crack depth filled with water
Circular Search Non-opt.=1.48 Optimized Shown



CH Multiple Trial: 97 pcf Multiple Trial: 180 psf 0 °
SP Multiple Trial: 125 pcf 0 psf Multiple Trial: 30 °
SM Multiple Trial: 105 pcf 0 psf 33 °
GW Multiple Trial: 130 pcf 0 psf Multiple Trial: 30 °
CL Fill Multiple Trial: 120 pcf Multiple Trial: 1300 psf 0 °
CL 97 pcf 840 psf 0 °

PLATE H-8

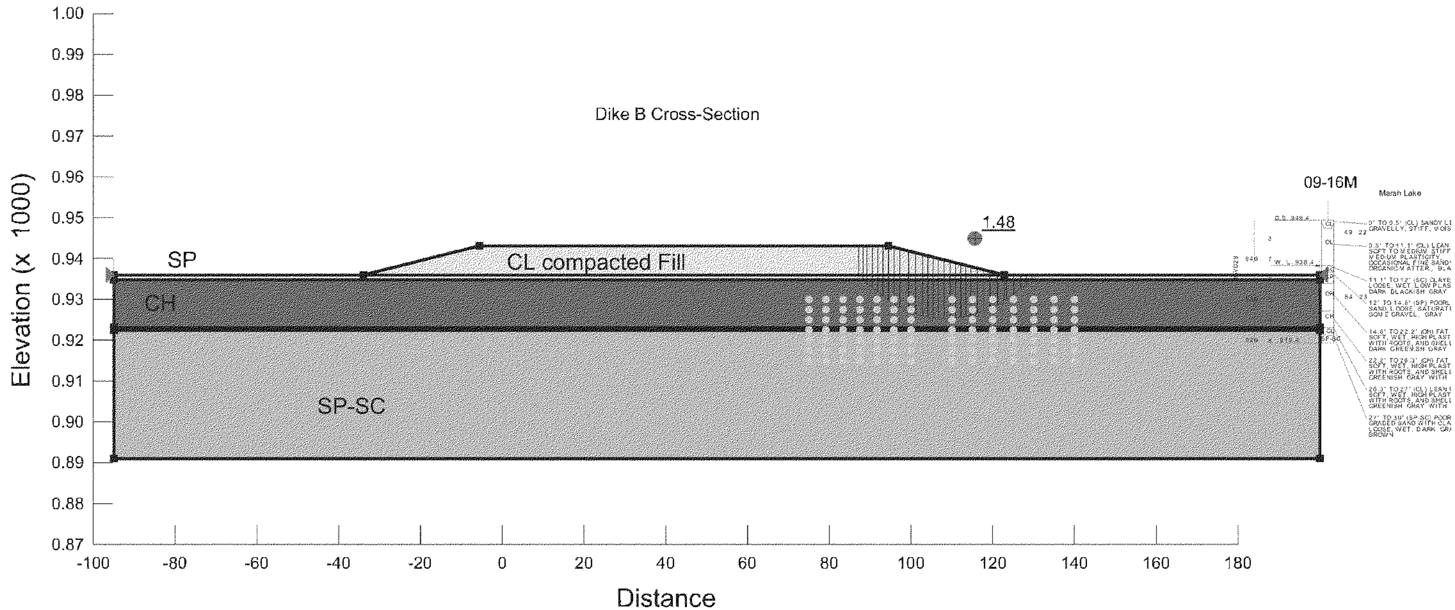
File Name: MarshLakeCDstrengths940top954.gsz Date: 12/9/2010
CD-STRENGTHS Pool Elev. 947.1, SAND CUTOFF, Downstream Water Surface Elev. 942.0
Non-Circular Search Non-opt. FS = 1.81 Optimized Shown



CH Multiple Trial: 97 pcf Multiple Trial: 0 psf 25 °
SP Multiple Trial: 125 pcf 0 psf Multiple Trial: 30 °
SM Multiple Trial: 130 pcf 0 psf 33 °
GW Multiple Trial: 130 pcf 0 psf Multiple Trial: 30 °
CL compacted Fill Multiple Trial: 120 pcf Multiple Trial: 0 psf 25 °
CL 113 pcf 200 psf 30 °

PLATE H-8

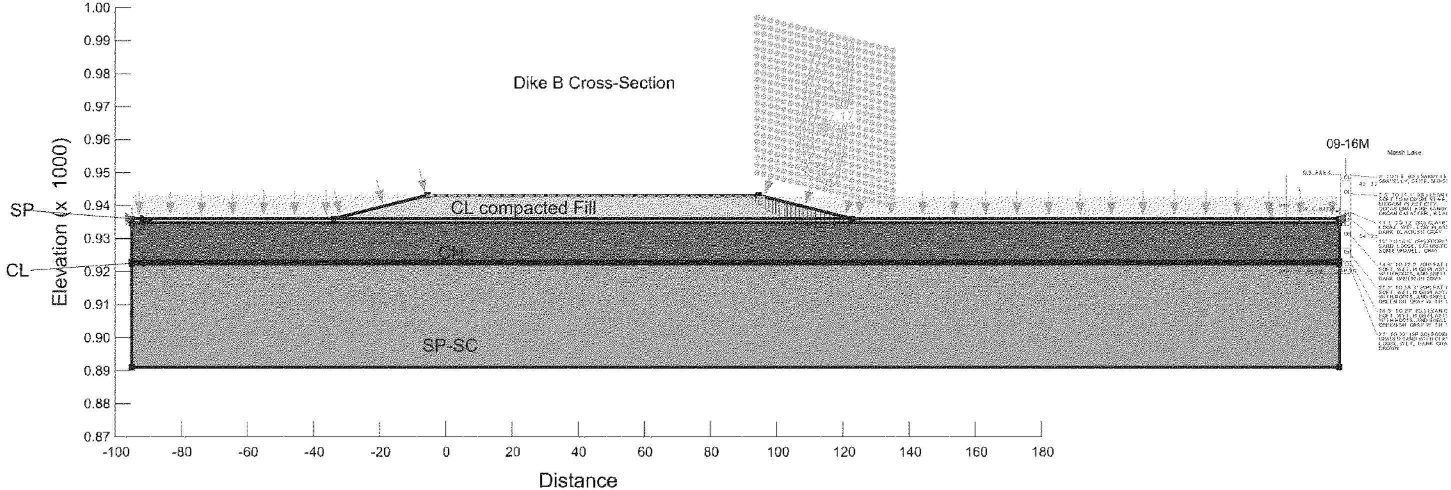
File Name: MarshLakeUUstrengthsDikeB.gsz Date: 12/2/2010
UU-STRENGTHS Search for Crack depth
Non-Circular Search Non-opt. FS = 1.62 Optimized Shown



CH Multiple Trial: 97 pcf Multiple Trial: 180 psf 0 °
SP Multiple Trial: 125 pcf 0 psf Multiple Trial: 30 °
SP-SC Multiple Trial: 130 pcf 0 psf Multiple Trial: 30 °
CL compacted Fill Multiple Trial: 100 pcf Multiple Trial: 1300 psf 0 °
CL 97 pcf 840 psf 0 °

PLATE H-8

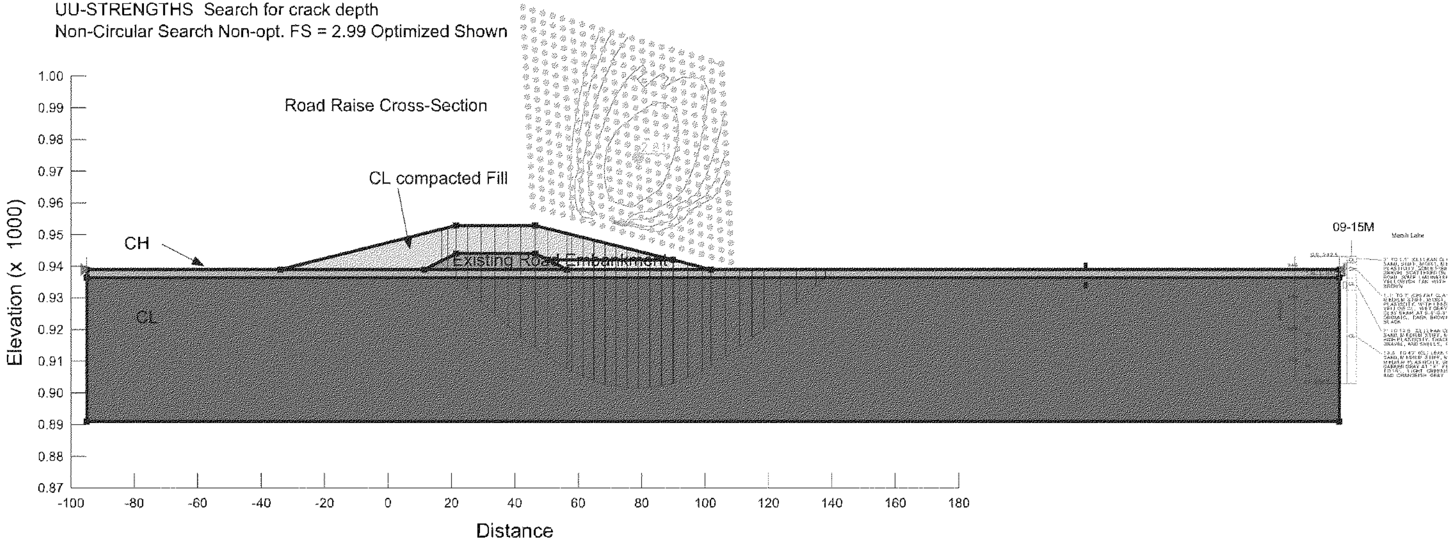
File Name: MarshLakeCDstrengthsDikeB.gsz Date: 12/2/2010
CD-STRENGTHS Downstream Water Surface Elev.=942.6
Circular Search Non-opt. FS= 2.20 Otimized Shown



CH Multiple Trial: 97 pcf Multiple Trial: 0 psf 25 °
SP Multiple Trial: 125 pcf 0 psf Multiple Trial: 30 °
SP-SC Multiple Trial: 130 pcf 0 psf Multiple Trial: 30 °
CL compacted Fill Multiple Trial: 120 pcf Multiple Trial: 0 psf 25 °
CL 97 pcf 0 psf 20 °

PLATE H-8

File Name: MarshLakeUUstrengthsRoadRaise.gsz Date: 3/1/2011
UU-STRENGTHS Search for crack depth
Non-Circular Search Non-opt. FS = 2.99 Optimized Shown



CL Multiple Trial: 97 pcf Multiple Trial: 840 psf 0 °
SP Multiple Trial: 125 pcf 0 psf Multiple Trial: 30 °
CL compacted Fill Multiple Trial: 120 pcf Multiple Trial: 1300 psf 0 °
Existing Road Embankment 100 pcf 1300 psf 0 °
CH 97 pcf 180 psf 0 °

PLATE H-8

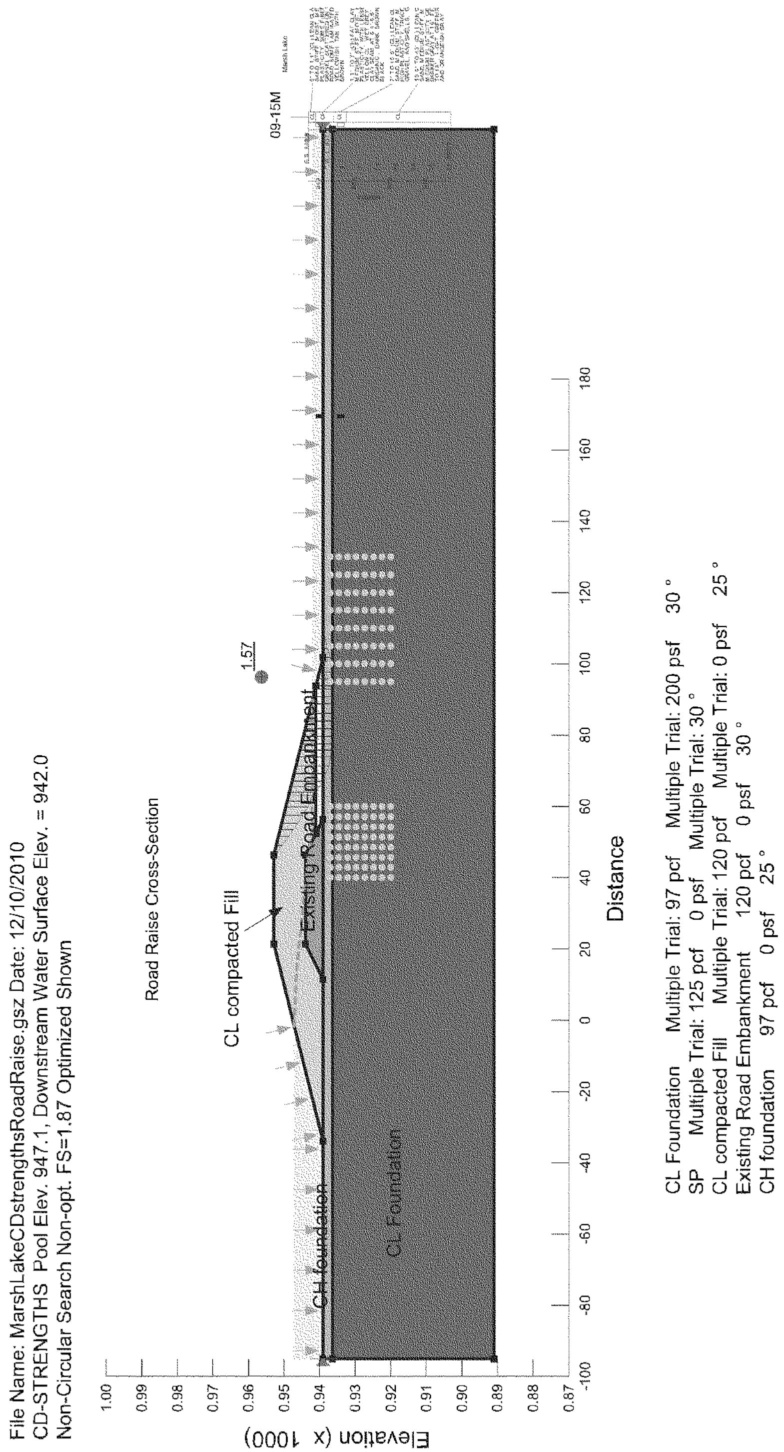

File Name: MarshLakeCDstrengthsRoadRaise.gsz Date: 12/10/2010
CD-STRENGTHS Pool Elev. 947.1, Downstream Water Surface Elev. = 942.0
Non-Circular Search Non-opt. FS=1.87 Optimized Shown
Road Raise Cross-Section
CL compacted Fill
1.57
Existing Road Embankment
CH foundation
CL Foundation
09-15M
Elevation (x 1000)
Distance
CL Foundation Multiple Trial: 97 pcf Multiple Trial: 200 psf 30 °
SP Multiple Trial: 125 pcf 0 psf Multiple Trial: 30 °
CL compacted Fill Multiple Trial: 120 pcf Multiple Trial: 0 psf 25 °
Existing Road Embankment 120 pcf 0 psf 30 °
CH foundation 97 pcf 0 psf 25 °

PLATE H-8

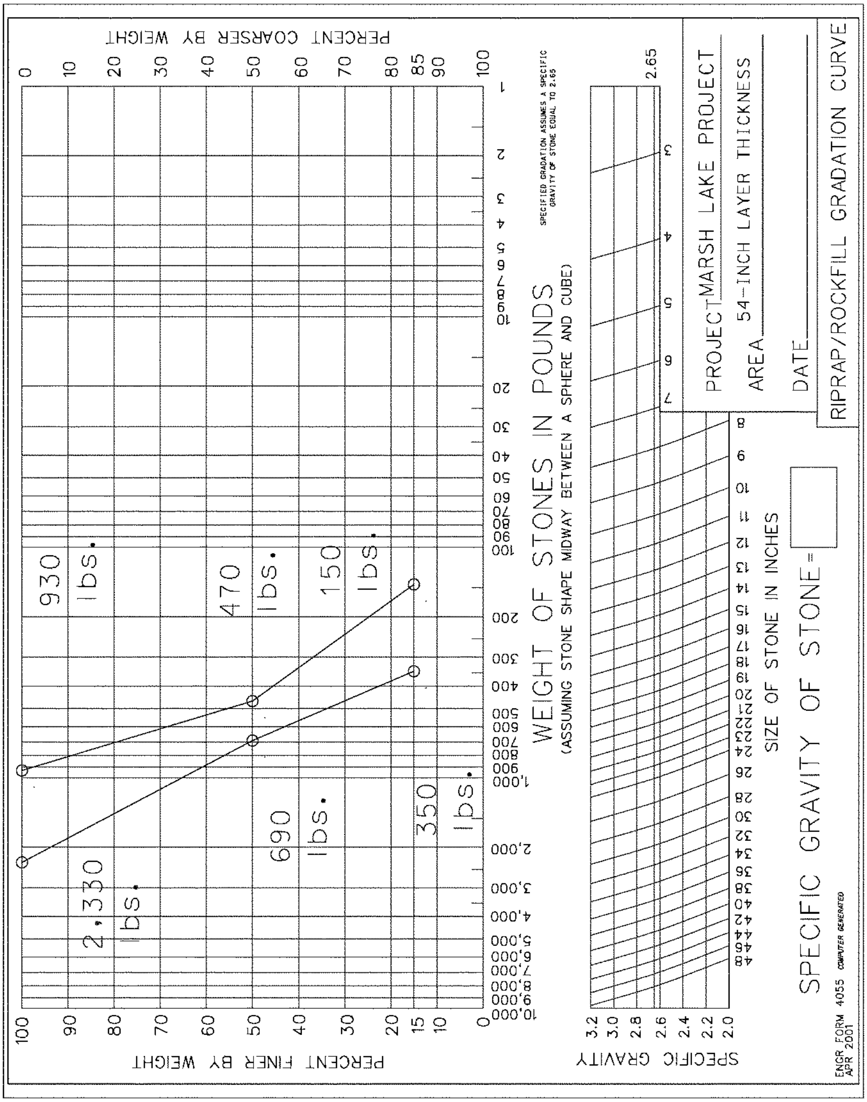

PERCENT COARSER BY WEIGHT
PERCENT FINER BY WEIGHT
WEIGHT OF STONES IN POUNDS
(ASSUMING STONE SHAPE MIDWAY BETWEEN A SPHERE AND CUBE)
SPECIFIED GRADATION ASSUMES A SPECIFIC GRAVITY OF STONE EQUAL TO 2.65
930 lbs.
470 lbs.
150 lbs.
2,330 lbs.
690 lbs.
350 lbs.
SIZE OF STONE IN INCHES
SPECIFIC GRAVITY
SPECIFIC GRAVITY OF STONE =
PROJECT MARSH LAKE PROJECT
AREA 54-INCH LAYER THICKNESS
DATE
RIPRAP/ROCKFILL GRADATION CURVE
ENGR FORM 4055 COMPUTER GENERATED
APR 2001

PLATE H-9

Appendix I – Recreation

RECREATION BENEFIT ANALYISIS

Marsh Lake, Minnesota

1.1 RECREATION BENEFIT ANALYSIS

Providing future recreational opportunities is an important part of this region by not only proving tourism dollars to the local economy but also providing a higher quality of life. An analysis of current local recreation, local user counts and studies, SCORP information, recreational professionals input and available State and Federal recreation was accomplished.

1.1.1 Recreation Benefits Without Site Facilities

Without the cost-shared proposed recreation features, recreation in the project area would be limited. Due to the lack of access to the project without the proposed recreation features, no recreation activities are forecasted to occur. Therefore no benefits were found for without-project conditions.

1.1.2 Recreation Challenges

The Marsh Lake Restoration plan with recreational features directly aligns with the Minnesota State Comprehensive Outdoor Recreation Plan (SCORP). Highlighted below are the five challenges listed for outdoor recreation in Minnesota along with the features included in this Feasibility Study that address these challenges.

- *Challenge #1 - Natural Resource Base*
  The highest priority is to address a declining natural resource base and the need to protect and restore the natural resource base on which outdoor recreation depends. Minnesota has a great deal of federal-, state- and county-owned or administered land, but most of it is in the northern third of the state and does not offer close-to-home recreational opportunities for most of the state's population. About two-thirds of all recreation use occurs within a half-hour drive from home, according to the 2004 Outdoor Recreation Participation Survey of Minnesotans.

- *Challenge #2 - Sustaining Existing Facilities*
  The Minnesota State Comprehensive Outdoor Recreation Plan (SCORP) calls for sustaining existing outdoor recreation facilities for future generations. The state still needs to invest in the outdoor recreation infrastructure to ensure that it is accessible, safe, energy efficient, economical to operate and maintain and flexible enough to accommodate changing needs.

  Project Features: Update Corps of Engineers Day Use facility at dam structure to include picnic area, comfort stations, and construction of a pedestrian bridge. Update boat ramps around Marsh Lake. Construct and update Canoe/Kayak launches and portage areas.

- *Challenge #3 - Healthy Lifestyle*
  SCORP noted the connection between outdoor recreation and a healthy lifestyle. If anything, this connection is even more relevant today. A 2006 survey by the United Health Foundation found that while Minnesotans are generally healthier than people in the rest of the country, yet there has been a 132 percent rise in the obesity rate of Minnesotans since 1990.

  Project Features: Pedestrian and bike bridge development across Marsh Lake spillway will provide connectivity to local and state bike trails. Canoe launch and portage area at dam location will provide connectivity for the Minnesota River State Water Trail.

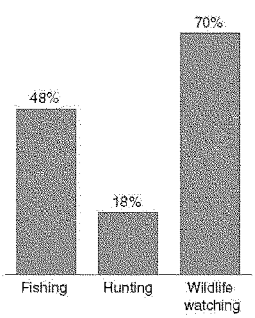
- *Challenge #4 - Connecting People and Nature*
  SCORP identified the need to expand nature-based outdoor recreation experiences for young people by providing "near-by" access to nature and allowing time for frequent unstructured play and exploration. SCORP expands the theme to include reconnecting many adult Minnesotans with the outdoors.

  Project Features: Provide interpretive kiosks at existing boat ramps on Marsh Lake to interpret the environmental and cultural features of this project and area. These kiosks will also acquaint people with the myriad of recreational opportunities available to them and within the nearby Minnesota River Corridor.

- *Challenge #5 - Population Changes*
  Although Minnesota's population has increased in recent years the project area's population has experienced a decline. Minnesota's population has become older, more culturally and ethnically diverse and more concentrated in urban and urbanizing areas. These changes mean that who participates in outdoor recreation, what activities they participate in, where they participate, why they participate and when they participate also have changed. (Refer to Section 2.9 Social and Economic Conditions)

  Participation rates in some activities, such as fishing and hunting, are declining. At the same time, participation rates in other activities, such as ATV-riding and kayaking are increasing. (MN SCORP) The fastest growth in outdoor recreation participation is projected for activities that are popular with older adults. These adults are more active and living longer than past generations. Older adults tend to participate in low impact activities such as bird watching, wildlife photography, biking, hiking, and fishing. (US Forest Service; Customer Diversity and the Future Demand for Outdoor Recreation, 1994.)

  Percent of Total Participants by Activity
  (Total: 3.0 million participants)



  Project Features: Provide canoe/kayak access area and portage area near spillway. This will actually provide a two for one – access to both the Minnesota River and Pomme de Terre River providing linkage to the Minnesota River State Water Trail. Update facilities at boat landings to include fishing and wildlife viewing platforms and interpretive kiosks. Update facilities to include accessibility.

1.1.3 Population Market Area

Population sources for Big Stone, Lac qui Parle, Swift and Chippewa Counties were obtained from the U.S. Census. For the purpose of this study, all four counties have been included in the Market Area population, see Table 1. A linear extrapolation of 2000-2008 US census figures was assuming a constant rate of change, was applied. This extrapolation methodology has been used in previous studies for MVP and is an acceptable method of acquiring quantifiable data and would reflect the best available data. This rate was calculated up to project year 2024 where the population was held constant to project year 2064. Due to the fluctuation of populations and increase in immigrants to the area[1], population trends appear to decline in the short term and plateau over time.

Table 1 – Market Area Population

Place	Base Population		Population Change	Population Predictions*					
	2000	2008	2000-08	2014	2024	2034	2044	2054	2064
Lac Qui Parle County	8,067	7,165	-11.2%	6,489	5,361	5,361	5,361	5,361	5,361
Chippewa County	13,088	12,414	-5.1%	11,909	11,066	11,066	11,066	11,066	11,066
Swiift County	11,956	11,035	-7.7%	10,345	9,193	9,193	9,193	9,193	9,193
Big Stone County	5,802	5,365	-7.5%	5,038	4,491	4,491	4,491	4,491	4,491
Regional Totals	**38,913**	**35,979**		**33,781**	**30,111**	**30,111**	**30,111**	**30,111**	**30,111**

*Linear extrapolation of 2000-2008 US census figures, assuming a constant rate of change.

1.1.4 Participation and Demand

The participation rate in per capita activity days for recreation activity was derived from reviewing the 2004 Outdoor Recreation Participation Survey of Minnesotans – Report on Findings. The rates used were taken from the South region for users. The participation rate change from 1999-2001 to 2005-2009 is from the Long-Term National Trends in Outdoor Recreation Activity Participation---1980 to Now, A Recreation Research Report in the IRIS Series. The rate was calculated up to project year 2034 in spite of unchanging regional population. This was based upon the growth in usage the Marsh Lake area has seen in the past several years as well as the growing older population who traditionally participate in more passive recreation such as wildlife viewing. [2] The increase in immigrant populations also plays a role in determining growth; day use activities are

[1] Pew Hispanic Center, (n.d.). *Demographic Profile of Hispanics in Minnesota, 2007.* Retrieved from http://www.pewhispanic.org

[2] Cordell, H. Ken, Green, Gary T., Betz, Carter J, USDA Forest Service, University of Georgia. May 2009. Long-Term National Trends in Outdoor Recreation Activity Participation –1980 to Now, A Recreation Research Report in the IRIS Series. Retrieved on September 14, 2009, from http://warnell.forestry.uga.edu/nrrt/nsre/IrisReports.html.

more prevalent in immigrant populations such as fishing and picnicking.[3] These participation rates are shown in Table 2.

Table 2 – Participation Rates (in Per Capita Activity Days) by Recreation Activity

Primary Activity:	Rate of Change	2004	2014	2024	2034	2044	2054	2064
Picnicking	0%	3.72	3.72	3.72	3.72	3.72	3.72	3.72
Wildlife Viewing	18%	18.84	21.99	25.14	28.29	28.29	28.29	28.29
Fishing	7%	1.76	1.87	1.97	2.08	2.08	2.08	2.08
Canoe/kayak	16%	0.51	0.59	0.66	0.74	0.74	0.74	0.74

Projected demands for (proposed) project-supported recreations are given in Table-3. The projected public use demand (in activity days) is calculated using recreation activity participation rates (Table-2), population projections for the surrounding counties from Table-1, recreation years and participation rates (per activity), and professional judgment in consultation with the MN DN, US Fish and Wildlife and other recreation and wildlife specialists. The years for depicting projected growth were chosen to reflect a fifty-year project life. Tables 3, 5 and 6 show 2014 as the first project year. This year is used in the tables because it is the proposed project construction completion date.

Table 3 – Market Area Activity Days

Primary Activity:		Year:									
		2014	2015	2016	2017	2018	2024	2034	2044	2054	2064
	Market Area Population:	33,781	33,414	33,047	32,680	32,313	30,111	30,111	30,111	30,111	30,111
Picnicking											
	Participation Rate	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72
	Activity Days/Year	125,665	124,300	122,935	121,570	120,204	112,013	112,013	112,013	112,013	112,013
Wildlife Viewing											
	Participation Rate	21.99	22.31	22.62	22.94	23.25	25.14	28.29	28.29	28.29	28.29
	Activity Days/Year	742,892	745,351	747,579	749,576	751,341	757,076	851,968	851,968	851,968	851,968
Fishing											
	Participation Rate	1.87	1.88	1.89	1.90	1.91	1.97	2.08	2.08	2.08	2.08
	Activity Days/Year	63,076	62,749	62,414	62,071	61,720	59,451	62,679	62,679	62,679	62,679
Canoe/Kayak											
	Participation Rate	0.59	0.59	0.60	0.61	0.62	0.66	0.74	0.74	0.74	0.74
	Activity Days/Year	19,781	19,819	19,851	19,877	19,898	19,908	22,183	22,183	22,183	22,183

1.1.5 Estimate of Current and Future Usage of Proposed Activities

Lacking a comprehensive site design, Table-4, establishing the maximum design capacity value, is a conservative estimate based on a concept (See Section 7.2 of the main report). Satisfactory limits on site visitation, feature conflicts, and neighborhood impacts would be established during the design phase of the proposed project. Visitation, parking, etc., will be adjusted to minimize negative social affects and over-use. Annual Primary

[3] Dunn, Robert A. 2002. Managing for Ethnic Diversity: Recreation Facility and Service Modifications for Ethnic Minority Visitors. Prepared for the U.S Army Corps of Engineers, Engineer Research and Development Center.

Activity Days were developed for the four site oriented recreational activities listed below in table 4. This was calculated by multiplying (supply of units) x (people per unit) x (turn over rate) x (weeks in season) and divided by (weekend day use) x (recreation season use). This formula determines the annual activity occasions which in turn is used to develop Annual Primary Activity Days as shown in Table 5. Design capacity values were based on Carrying Capacity guidelines in the "Optimum Recreation Carrying Capacity" developed for the U.S. Department of the Interior in 1977.

A Primary Activity Day (or visitor day) is a standard unit of use consisting of a visit by an individual to a recreation area during a 24-hour period. People often engage in more than one activity occasion during any given recreational site visit. A person engaged in bicycling, walking/jogging, or picnicking, etc., tends to participate in more than one activity per day; they might also bird watch or photograph the outdoors on the same day. The Primary Activity Day therefore, is considered to consist of 1.25 activity occasions/day for most types of recreation. The Annual Primary Activity Days listed in Table 5 was derived from dividing the annual capacity in occasions by the activity day factor. This was necessary so as to avoid double counting of visitors engaging in more than one activity during the day.

Based upon the growth in usage the Marsh Lake area has seen in the past several years picnicking, fishing, canoeing and wildlife viewing, was projected at 40 percent of capacity the first year, 50 percent of capacity the second year, 60 percent capacity the third year, 80 percent capacity the fourth year and full capacity the fifth year.

Table 4 – Project Recreation Features: Maximum Capacity and Expected Use

Site Recreation, Design Capacity Values						
Primary Activity	(u)= Supply of Units	(p) = People per Unit	(t) = Turnover Rate	(s) = Weeks in Season	(w) = Weekend Day Use	(y) = Recreation Season Use
Picnicking	4	4	2	18	30%	70%
Fishing	21	2	2	22	20%	65%
Canoeing*	36	2	1	18	30%	65%
Wildlife Viewing	72.5					

*The limiting factor for supply of units for canoeing is the boat launch rather than the available area. Assuming 20 minutes per launch (1) over a 12-hour day

Table-5 shows estimated recreation site capacity (from Table-4, converted to activity days) by major recreation activities that would be supported by the project.

Table 5 – Estimated Annual Use, Per Site and Activity

Primary Activity:	Activity Occasions*	Conversion Factor	Activity Days (2014)	Activity Days (2015)	Activity Days (2016)	Activity Days (2017)	Activity Days (2018-2064)
Picnicking	2,743	1.25	878	1,098	1,317	1,756	2,195
Fishing	14,215	1.25	4,549	5,687	6,824	9,098	11,373
Canoeing	6,646	1.25	2,127	2,659	3,190	4,254	5,317
Total Site Activity Days			7,554	9,443	11,331	15,108	18,885
SUBTOTAL ACTIVITY DAYS			7,554	9,443	11,331	15,108	18,885
Wildlife Viewing**	72.5%	1.25	4,382	5,477	6,572	8,763	10,954
TOTAL ANNUAL PRIMARY ACTIVITY DAYS***			11,936	14,920	17,903	23,871	29,839

* Capacity of Recreation Use in Activity Occasions = upts/wy
**72.5% of Total Activity Days for Site Recreation
***Annual Primary Activity Day numbers may contain rounding errors

1.1.6 Annual Recreation Benefits

Table-6 shows the projected recreation visitation over the life of the project. The design provides a positive social value in that less popular forms of recreation can also be supported and provided by the project's main features at little or no additional cost. Noting the excess demand for each activity, it is evident the project will provide a positive percentage of the market area recreation needs for years to come. Visitation growth of the project is tied to recreation growth as indicated by the Long-Term National Trends in Outdoor Recreation Activity Participation and the population growth expected for the region.

The numbers shown may be somewhat affected by final site design, as stated earlier. Other factors that could affect these values are: changes outside of the population value ranges estimated, enlarging the recreation sites and features, additional recreation features, climate change, or the addition of recreation features not supported by this project.

Table 6 – Project Recreation and Excess Demand

Primary Activity:		Year:									
		2014	2015	2016	2017	2018	2024	2034	2044	2054	2064
Picnicking											
(Table 3)	Market Zone Demand	125,665	124,300	122,935	121,570	120,204	112,013	112,013	112,013	112,013	112,013
(Table 5)	Demand Met by Proposed Facilities	878	1,098	1,317	1,756	2,195	2,195	2,195	2,195	2,195	2,195
	Excess Demand	124,787	123,203	121,618	119,814	118,009	109,818	109,818	109,818	109,818	109,818
Wildlife Viewing											
(Table 3)	Market Zone Demand	742,892	745,351	747,579	749,576	751,341	757,076	851,968	851,968	851,968	851,968
(Table 5)	Demand Met by Proposed Facilities	4,382	5,477	6,572	8,763	10,954	10,954	10,954	10,954	10,954	10,954
	Excess Demand	738,510	739,874	741,007	740,813	740,387	746,122	841,014	841,014	841,014	841,014
Fishing											
(Table 3)	Market Zone Demand	63,076	62,749	62,414	62,071	61,720	59,451	62,679	62,679	62,679	62,679
(Table 5)	Demand Met by Proposed Facilities	4,549	5,687	6,824	9,098	11,373	11,373	11,373	11,373	11,373	11,373
	Excess Demand	58,527	57,062	55,590	52,973	50,347	48,078	51,306	51,306	51,306	51,306
Canoe/Kayak											
(Table 3)	Market Zone Demand	19,781	19,819	19,851	19,877	19,898	19,908	22,183	22,183	22,183	22,183
(Table 5)	Demand Met by Proposed Facilities	2,127	2,659	3,190	4,254	5,317	5,317	5,317	5,317	5,317	5,317
	Excess Demand	17,654	17,160	16,661	15,624	14,581	14,591	16,866	16,866	16,866	16,866

1.1.7 Unit Day Values

The Unit Day Value (UDV) method was used to determine daily recreation benefits. This method was chosen because local wildlife and recreation experts were extremely knowledgeable and provided ample data regarding the existing recreation opportunities as well as needs and priorities for Marsh Lake. UDV was also chosen because the recreation facilities will not influence the project selection and the total project annual visits are also not forecasted to be more than 750,000.

Unit day values were developed for each recreational activity. This methodology relies on professional judgment to assign point values to five specific criteria:

- Recreation Experience—pertains to the availability and quality of activities on site.
- Availability of Opportunity—is specific to travel times and scarcity of activities.
- Carrying Capacity—concerns the level of site recreation development.
- Accessibility—pertains to the ease of access, specifically by automobile.
- Environmental—is specific to the aesthetic qualities of the site and surrounding areas.

The total points assigned are converted to a unit-day value, which is then applied to the estimated visitation to derive the overall benefits. The points were assigned to the criteria as outlined in Table-7. These points were then converted to a Unit Day Value using "General Recreation" point-to-value data for Fiscal Year 2010, with a range for general recreation of $3.58 -$10.75.

This method is outlined in the *Economics Guidance Memorandum 11-03, Unit Day Values for Recreation, Fiscal Year 2011.* The table provided in the memorandum was adjusted from Table K-3-1, Federal Register Vol. 44, No. 242, p.72962, December 4, 1979, using the CPI factor.

Point assignment for both types of recreation is assumed using parameters outlined in the memorandum and assumptions by a recreation professional. Points are adjusted, from a maximum assignment, by judgment factors set forth for each criterion. Maximum points vary according to the criteria and are shown in Table-7.

Table 7 – Unit Day Values

Criteria and (Maximum Points)	Picnicking	Wildlife Viewing	Canoe / kayak	Fishing
Recreation Experience (30)	12	23	23	23
Availability (18)	3	3	3	3
Carrying Capacity (14)	8	10	5	8
Accessibility (18)	12	15	7	7
Environmental Quality (20)	8	8	10	10
Total Points Assigned (100)	43	59	48	51
Unit Day Values*	**6.99**	**8.22**	**7.44**	**8.38**
2011 UDV = $3.58 -$10.75				

1.1.8 Benefit Computation

Recreation benefits attributable to the proposed site recreation facilities were based on projected demand for the primary activities listed in Table 6. These demand estimates over the period of analysis were used in conjunction with Unit Day Values developed for each of the recreational activities. Demand at each project year was multiplied by the appropriate Unity Day Value for each recreation activity. The value of the recreation activity at each project year was converted to a present worth value using a 4 1/8 percent annual interest rate. The sum of these present worth values, by recreational activity were converted to an average annual dollar value, given a 50 year project life and a 4 1/8 percent annual interest rate. Table 8 shows the Average Annual Benefit summary.

Table 8 – Project Recreation Average Annual Benefit

Picnicking	$	14,381
Wildlife Viewing	$	84,393
Fishing	$	89,327
Canoe/kayak	$	36,828
TOTAL ANNUAL AVG BENEFITS	**$**	**224,929**

The present value of estimated construction costs, contingencies, engineering, design, construction management, and interest during construction were calculated to be $447,800. This present value was amortized at 4 1/8 percent over the 50-year life of the project. The resulting annualized cost of $21,293.33 was added to the estimated annual operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) cost of $2,161 for a total annual cost of $23,454.33. The net annual benefits, or the annual benefits minus the annual costs, are $201,474.67. The benefit-cost ratio, or the annual benefits divided by the annual costs, was calculated to be 9.59. Therefore, the Marsh Lake proposed recreation plan is economically justified. The Federal costs of the Marsh Lake Ecosystem Restoration project with the recreation facilities would be approximately .4 percent greater than the Federal costs of the project without the recreation facilities, less than the 10 percent limit, in accordance with ER 1105-2-100.

1.2 REFERENCES

- 2004 Outdoor Recreation Participation Survey of Minnesotans – Report on Findings, Tim Kelly, Office of Management and Budget Services, Minnesota Department of Natural Resources, January 2005.

- Economics Guidance Memorandum 11-03, Unit Day Values for Recreation, Fiscal Year 2011, U.S. Army Corps of Engineers, November 2010.

- ER 1105-2-100, Planning Guidance Notebook, U.S. Army Corps of Engineers. April 22, 2000.

- Long-Term National Trends in Outdoor Recreation Activity Participation –1980 to Now, H. Ken Cordell, Gary T. Green and Carter J. Betz, May 2009.

- Minnesota's Outdoor Legacy: Strategy for the 90's. Statewide Comprehensive Outdoor Recreation Plan for 1990-1994, Minnesota Departments of Natural Resources and Trade and Economic Development. 1990.

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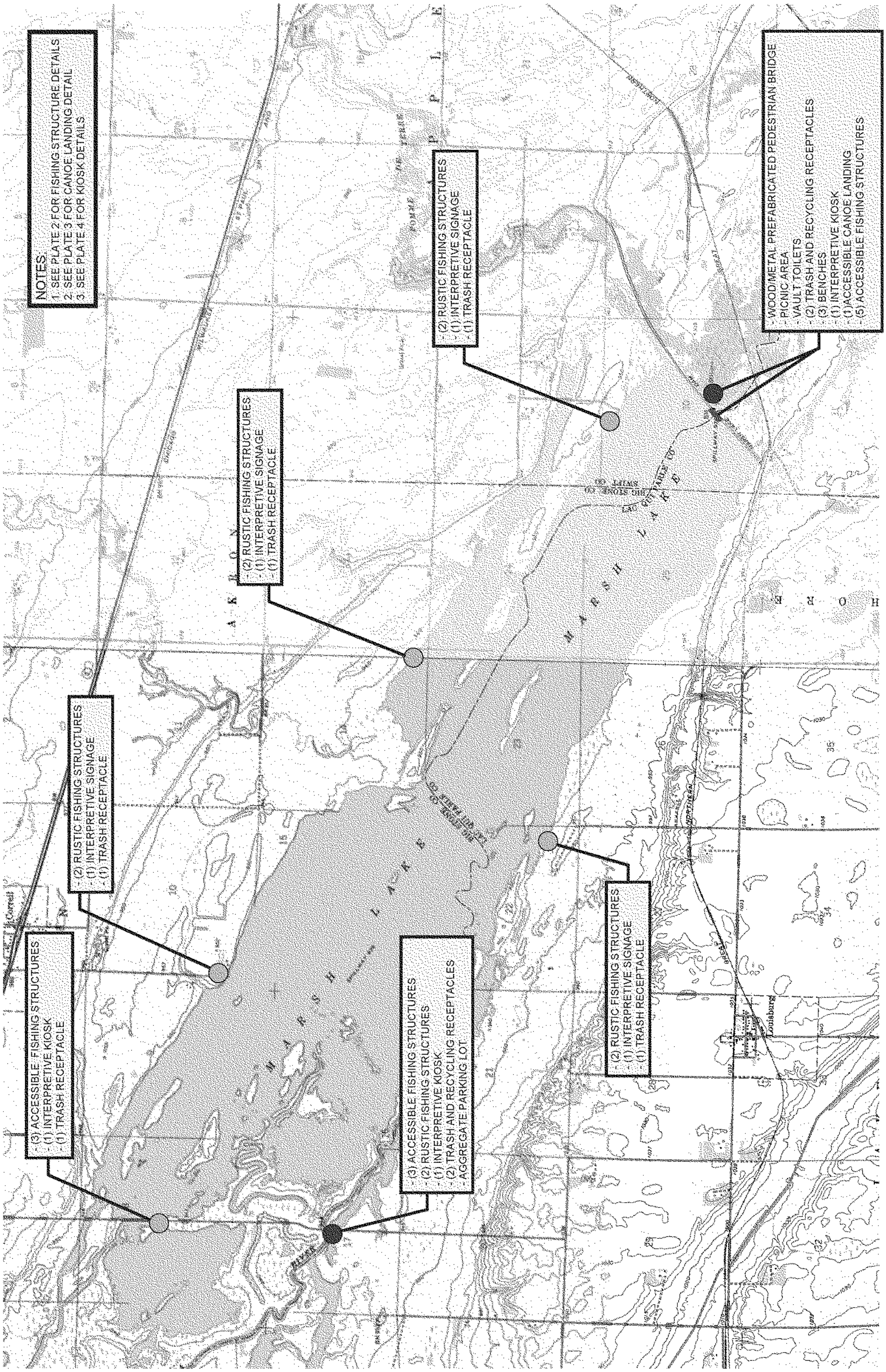
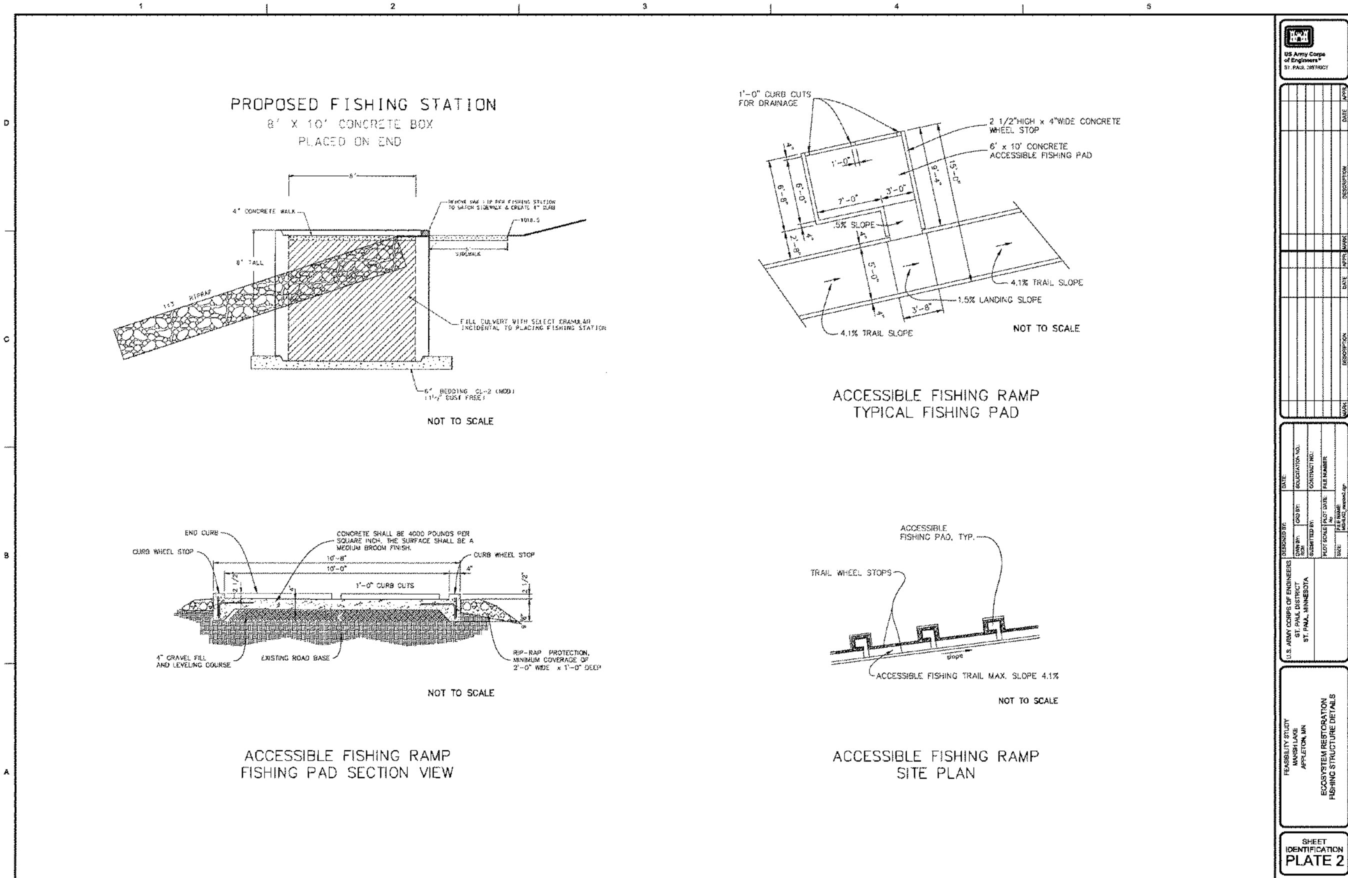
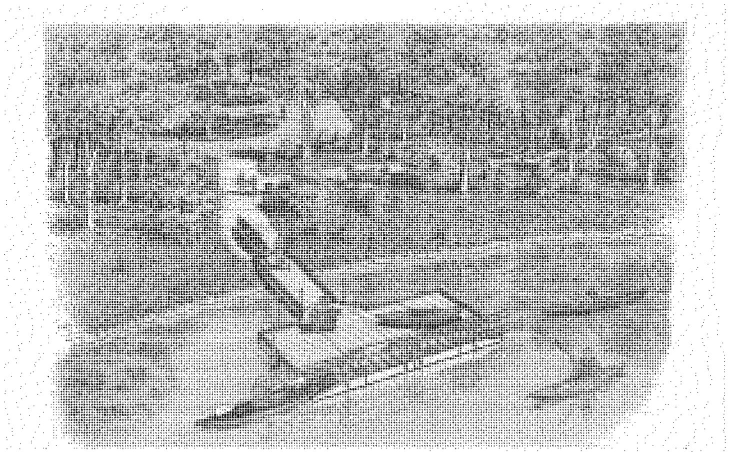
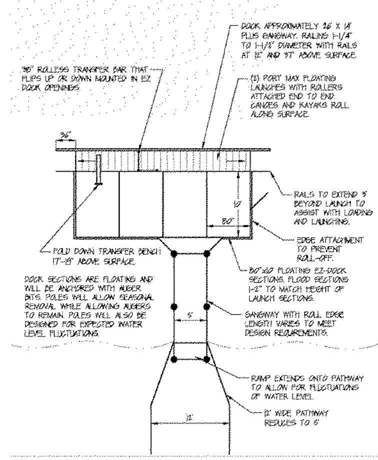

NOTES:
1. SEE PLATE 2 FOR FISHING STRUCTURE DETAILS
2. SEE PLATE 3 FOR CANOE LANDING DETAIL
3. SEE PLATE 4 FOR KIOSK DETAILS
· (3) ACCESSIBLE FISHING STRUCTURES
· (1) INTERPRETIVE KIOSK
· (1) TRASH RECEPTACLE
· (2) RUSTIC FISHING STRUCTURES
· (1) INTERPRETIVE SIGNAGE
· (1) TRASH RECEPTACLE
· (3) ACCESSIBLE FISHING STRUCTURES
· (2) RUSTIC FISHING STRUCTURES
· (1) INTERPRETIVE KIOSK
· (2) TRASH AND RECYCLING RECEPTACLES
· AGGREGATE PARKING LOT
· (2) RUSTIC FISHING STRUCTURES
· (1) INTERPRETIVE SIGNAGE
· (1) TRASH RECEPTACLE
· (2) RUSTIC FISHING STRUCTURES
· (1) INTERPRETIVE SIGNAGE
· (1) TRASH RECEPTACLE
· (2) RUSTIC FISHING STRUCTURES
· (1) INTERPRETIVE SIGNAGE
· (1) TRASH RECEPTACLE
· WOOD/METAL PREFABRICATED PEDESTRIAN BRIDGE
· PICNIC AREA
· VAULT TOILETS
· (2) TRASH AND RECYCLING RECEPTACLES
· (3) BENCHES
· (1) INTERPRETIVE KIOSK
· (1) ACCESSIBLE CANOE LANDING
· (5) ACCESSIBLE FISHING STRUCTURES
M A R S H L A K E
M A R S H L A K E
Louisburg


PROPOSED FISHING STATION
8' X 10' CONCRETE BOX
PLACED ON END
4" CONCRETE WALK
8' TALL
RIPRAP
FILL CULVERT WITH SELECT GRANULAR
INCIDENTAL TO PLACING FISHING STATION
NOT TO SCALE
1'-0" CURB CUTS
FOR DRAINAGE
2 1/2"HIGH x 4"WIDE CONCRETE
WHEEL STOP
6' x 10' CONCRETE
ACCESSIBLE FISHING PAD
.5% SLOPE
4.1% TRAIL SLOPE
1.5% LANDING SLOPE
4.1% TRAIL SLOPE
NOT TO SCALE
ACCESSIBLE FISHING RAMP
TYPICAL FISHING PAD
END CURB
CURB WHEEL STOP
CONCRETE SHALL BE 4000 POUNDS PER
SQUARE INCH. THE SURFACE SHALL BE A
MEDIUM BROOM FINISH.
CURB WHEEL STOP
1'-0" CURB CUTS
4" GRAVEL FILL
AND LEVELING COURSE
EXISTING ROAD BASE
RIP-RAP PROTECTION,
MINIMUM COVERAGE OF
2'-0" WIDE x 1'-0" DEEP
NOT TO SCALE
ACCESSIBLE FISHING RAMP
FISHING PAD SECTION VIEW
ACCESSIBLE
FISHING PAD, TYP.
TRAIL WHEEL STOPS
ACCESSIBLE FISHING TRAIL MAX. SLOPE 4.1%
NOT TO SCALE
ACCESSIBLE FISHING RAMP
SITE PLAN
US Army Corps
of Engineers
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS
ST. PAUL DISTRICT
ST. PAUL, MINNESOTA
FEASIBILITY STUDY
MARSH LAKE
APPLETON, MN
ECOSYSTEM RESTORATION
FISHING STRUCTURE DETAILS
SHEET
IDENTIFICATION
PLATE 2



* Pam Blough, PM Blough, Inc. (2/23/2009) *Universally Accessible Canoe and Kayak Launch.*
Retrieved from http://www.designingaccessiblecommunities.org



NOT TO SCALE

ACCESSIBLE CANOE
AND KAYAK LAUNCH*

US Army Corps of Engineers
ST. PAUL DISTRICT

MARK	DESCRIPTION	DATE	APPR.	MARK	DESCRIPTION	DATE	APPR.

U.S. ARMY CORPS OF ENGINEERS
ST. PAUL DISTRICT
ST. PAUL, MINNESOTA

DESIGNED BY: | DATE:
DWN BY: | CKD BY: | SOLICITATION NO.:
SUBMITTED BY: | CONTRACT NO.:
PLOT SCALE: | PLOT DATE: | FILE NUMBER:
SIZE: | FILE NAME:

FEASIBILITY STUDY
MARSH LAKE
APPLETON, MN
ECOSYSTEM RESTORATION
CANOE LAUNCH DETAIL

SHEET IDENTIFICATION
PLATE 3

EXAMPLES OF
INFORMATION/EDUCATIONAL
KIOSKS AND SIGNAGE*

* Image collage courtesy of SRF Consulting Group, Inc.

US Army Corps of Engineers
ST. PAUL DISTRICT

U.S. ARMY CORPS OF ENGINEERS
ST. PAUL DISTRICT
ST. PAUL, MINNESOTA

FEASIBILITY STUDY
MARSH LAKE
APPLETON, MN
ECOSYSTEM RESTORATION
INFORMATION/EDUCATION KIOSK DETAILS

SHEET IDENTIFICATION
PLATE 4

Appendix J – Hydrology and Hydraulics

Marsh Lake Dam

Ecosystems Restoration Feasibility Study

Hydraulics & Hydrology Appendix

January 2011

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List of Tables

I. General

The Lac qui Parle Project is located on the Minnesota River in western Minnesota near the South Dakota state line. The project lies along the northeasterly boundary of Lac qui Parle County and the southwesterly boundaries of Chippewa, Swift, and Big Stone Counties. The actual Marsh Lake Dam, which is part of the greater Lac qui Parle Project, is 303.5 River miles above the mouth of the Minnesota River and is located near Appleton, Minnesota just downstream of the Pomme de Terre River.

The purpose of this appendix is to provide feasibility level hydraulic designs for several proposed ecosystem restoration features on Marsh Lake and evaluate impacts of those features in terms of their ability to meet ecosystem objectives, flood impacts, and dam safety.

Much of the design utilized existing hydrologic and hydraulic (H&H) data, which is outlined in Section II. Other H&H data, including unsteady water level models using HEC-RAS software, was developed for the current feasibility study and is detailed in Section III.

II. Hydrologic and Hydraulic Data (previously developed)

1. Pool and Tailwater Elevation Frequency Curve.

   Analysis is taken from "Section 22 Study, Minnesota River Main Stem Hydrologic Analyses, October 2001". Graphical frequency plots are shown in Plates 1-2.

	10% Event	2% Event	1% Event	0.5% Event
Pool Elevation	942.5	945.4	947.4	949.2
Tailwater Elevation	941.8	943.5	944.6	945.8

Table 1. Summary of Results from Marsh Lake Frequency Analysis

2. Minnesota River Standard Project Floods & Probable Maximum Floods.

   Standard Project Floods and Probable Maximum Floods for several locations near to Marsh Lake were developed in "Report on Probable Maximum Floods (PMF) and Standard Project Floods, (SPF) Minnesota River Basin, St Paul District Corps of Engineers, January 1971". No PMF or SPF was developed specifically for Marsh Lake in the report, but the unit hydrograph shape for the Lac Qui Parle Dam was adapted for the development of the Frequency Inflow Hydrographs (section 5).

3. Probable Maximum Flood.

   The Probable Maximum Flood (PMF) specifically for Marsh Lake was developed in "Dam Failure Planning Report, Marsh Lake Dam, Minnesota River, St Paul District Corps of Engineers, August 1987". An inflow hydrograph with a peak of 109,000 cfs was adopted as the PMF for Marsh Lake Dam. Routing of the PMF through the reservoir with an antecedent pool equal to 937.6 resulted in a peak pool elevation of 952.0 (approximately 2' above the top of the embankment). The graphical PMF inflow hydrograph for Marsh Lake is shown in Plate 3.

4. Spillway Design Flood.

The spillway design flood for Marsh Lake was developed in "Dam Failure Planning Report, Marsh Lake Dam, Minnesota River, St Paul District Corps of Engineers, August 1987". The PMP hyetograph was reduced to obtain a peak stage in the Marsh Lake reservoir of 947.1 (3' of freeboard). The resultant inflow hydrograph has a peak flow of 21,000 cfs. The SDF inflow hydrograph for Marsh Lake is shown in Plate 6.

5. Flow Frequency Analysis for Pomme de Terre River at Appleton

The peak discharges on the Pomme de Terre River at Appleton are taken from the Flood Insurance Study, City of Appleton, Swift County, Minnesota dated October 1981 and are shown in Table 2 below.

	Peak Discharges, in cfs			
	10-year	50-year	100-year	500-year
Pomme de Terre River at Appleton	2,620	5,300	6,700	11,000

Table 2. Summary of Peak Discharges at Appleton, MN

6. Surveys of Lake Bathymetry

Two lakebed bathymetry surveys are available for Marsh Lake. The Corps of Engineers collected lake bed elevations during the winter of 1991 and the Minnesota Department of Natural Resources collected approximate lake bed elevations referenced to the pool level during a vegetation survey during the summer of 1992.

III. Hydrologic and Hydraulic Data (developed for current study)

7. Historic Inflows and Pool Elevations

Historic inflows into Marsh Lake were obtained for the period from September 1984 to September 2003. The historic inflows consist of outflows from the Highway 75 dam on the Minnesota River, rated flows on the Pomme de Terre at Appleton, and local inflows to Lac Qui Parle Reservoir. Historic pool and tailwater elevations for Marsh Lake were also obtained for use in the calibration of an unsteady model for Marsh Lake.

8. HEC-RAS Unsteady water level model

An unsteady water level model for Marsh Lake was developed for this study using HEC-RAS. The model was calibrated to Marsh Lake Pool Elevations using historic inflows and used primarily for determining the effect of proposed feasibility features to Marsh Lake water levels. The model was also used to estimate the downstream impacts of the proposed project on Lac Qui Parle reservoir and downstream on the Minnesota River at Montevideo. A georeferenced schematic of the HEC-RAS model, which includes Marsh Lake, Marsh Lake Dam, the Minnesota River, Lac Qui Parle Reservoir, Lac Qui Parle Dam, and the Pomme de Terre River, is shown in Plate 23.

The calibrated existing conditions model was altered to determine effects of specific proposed project features on Marsh Lake water levels. Simulations were performed over the 20 year period

(1983-2003) for 1) existing conditions, 2) re-routing of the lower Pomme de Terre River, and 3) re-routing of the Lower Pomme de Terre River combined with a modified primary spillway/fishway.

Separately, unsteady flow simulations were also performed to determine the size of drawdown structure required to achieve desired water level and habitat goals (see section 15). This was done using simplified model geometry (based on calibrated existing conditions geometry) with only the Marsh Lake Reservoir and assuming no tail water submergence at the dam. This model was used to determine the time required to achieve a drawdown (from 938.3 to 935.5) and the duration of water level increases (i.e. "bounce") during a 5 year summer storm during drawdown (935.5).

The model geometry combined data from several sources, outlined in Table 3 below.

Geometry	***Source***
Pomme de Terre River (upstream cross sections)	HEC-2 modeling from FIS study
Pomme de Terre River (downstream cross sections)	Recent field surveys
Marsh Lake Reservoir Elevation-Storage relationship	Water Control Manual (Reference 4)
Minnesota River Downstream of Marsh Lake Dam	Combination of recent field surveys and estimated cross sections
Marsh Lake Dam Primary Spillway	As built: 112' wide, sill elevation of 937.6'
Marsh Lake Dam Overflow Spillway	As built: 90' wide, elevation of 940.0'
Marsh Lake Dam Low Flow Conduit	As built: 2' x 2' square gated conduit, invert of 935.0'. Approximated as 2'x1' conduit to simulate actual operation
Lac Qui Parle Reservoir Elevation-Storage relationship	Water Control Manual (Reference 4)
Lac Qui Parle Dam Outlet Structures	As built drawings
Minnesota River Downstream of Lac Qui Parle	Previous Compilation of FIS study model data

Table 3. Source of HEC-RAS Model Geometry

Calibration of HEC-RAS Water Level Model (existing conditions)

The primary purpose of the unsteady modeling was to evaluate changes to the water level conditions on Marsh Lake between existing conditions and with project conditions, and the initial of the calibration effort focused on matching historic Marsh Lake pool elevations. All HEC-RAS model runs were made using HEC-RAS version 4.1.0 Jan 2010.

Inflows: Historic inflows for the modeling effort were obtained from a variety of sources and described in the table below.

Inflow	**Source**
From HWY 75 Dam to Marsh Lake	USACE Water Control Records (computed flow)
Pomme de Terre River at Appleton	USGS Gage Records (flow)
Combined Lac Qui Parle Reservoir Inflows (Lac Qui Parle River, Chippewa Diversion, and Local)	Combination of Watson Sag, Lac Qui Parle River, and local inflows based on gage records from USGS and USACE

Table 4. Sources of Inflow Data for Modeling

N-Values: Three distinct river reaches were modeled: Pomme de Terre River from Appleton downstream to Marsh Lake, Minnesota River downstream of Marsh Lake to Lac Qui Parle Reservoir, and the Minnesota River downstream of Lac Qui Parle to Montevideo. The Pomme de Terre River used n-values of 0.45 for the main channel and 0.07 for the overbank areas, which are reasonable typically for streams similar to the Pomme de Terre and result in stages in Appleton that match observed data. The Minnesota River downstream of Marsh Lake Dam used n-values of 0.028 for the main channel and 0.053 for the overbank areas, which are typical of streams similar to this reach of the Minnesota River. The Minnesota River downstream of Lac Qui Parle Dam used n-values ranging from 0.02-0.05 for the main channel and values ranging from 0.04-0.08 in the overbank areas, which were taken directly from the previously calibrated model based on the Flood Insurance Study (FIS).

Lac Qui Parle Gates: Marsh Lake Dam is subject to relatively frequent tailwater submergence and is dependent on the operation of the gates on the Lac Qui Parle Dam. The existing conditions model was calibrated to Marsh Lake Pool elevations using an automated gate operating scheme based on pool elevation that maintains the Lac Qui Parle reservoir elevation between 933' and 935' during low inflows and allows for larger outflows during floods (shown in Table 4). This operating scheme is approximately representative of the operation of the gates at Lac Qui Parle according the Water Control Manual (Reference 4).

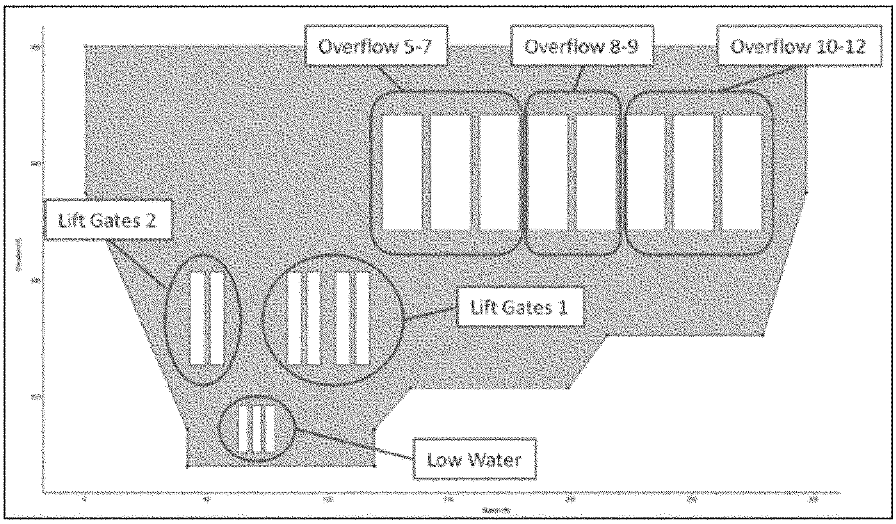

Figure 1. Schematic of Modeled Lac Qui Parle Dam Gates.

	Gate Group Name					
	Lift Gates 1	Low Water	Lift Gates 2	Overflow 5-7	Overflow 8-9	Overflow 10-12
Trigger Elevation to Open	941.1	960	935	941.1	941.1	941.1
Trigger Elevation to Close	940	915	933	940	940	940
Maximum Opening	8	4	8	10	10	10
Minimum Opening	0	0	0	10	3.5	0
Total Width of Gate Group	12	12	24	51	34	51

Table 5. Summary of Simplified Lac Qui Parle Gate Operations used in HEC-RAS modeling

Downstream Boundary Condition: The downstream boundary condition for the model was on the Minnesota River at Montevideo using normal depth with a friction slope of 0.00005. The model was not calibrated for stages at Montevideo, but the downstream boundary is considered to provide reasonable results for the tailwater at Lac Qui Parle Dam and peak flow routing from Lac Qui Parle down to Montevideo.

Marsh Lake Dam Outlets: Marsh Lake dam (existing conditions) consists of 3 distinct outflow features: a 2' gated conduit, a primary spillway, and an auxiliary spillway. The primary spillway is an ogee crested concrete structure which was modeled using a weir coefficient of 3.6. The auxiliary spillway is a grouted rip-rap section cut through the embankment, a weir coefficient of 3.0 was used, which is higher than the default of 2.6 for a broad-crested weir, but chosen to better match the historic pool elevation data. The small, low flow conduit was modeled using HEC-RAS culvert routine and typical values for roughness and loss coefficients. The existing conditions model was calibrated using the available historic inflows and Marsh Lake Pool level data for the 20 year period of October 1984 to September 2003. Results of the calibration are shown on Plates 24-28.

<u>Modeling of With-Project Conditions</u>

In order to estimate Marsh Lake water level changes for existing versus project conditions, the existing conditions model was altered to reflect proposed project conditions.

Primary Spillway: The modification to the primary spillway was modeled as a family of rating curves for various head and tail water conditions, which were determined using a steady flow HEC-RAS model described in section 9 and shown in the figure below.

Auxiliary Spillway: The auxiliary spillway will be modified under proposed conditions to include a stop-log structure will allow for periodic water level drawdowns on Marsh Lake. The structure will have the same width as the existing spillway. For the purposed of feasibility level design, the auxiliary spillway dimensions and weir coefficients was not altered.

Lower Pomme de Terre River: The return of the Pomme de Terre to its historic channel was modeled by altering the lower reach to include and appropriate centerline alignment and utilized surveyed cross sections in the area as well as dimensions of the proposed bridge over the Pomme de Terre at the dam access road.

9. HEC-RAS fish ramp model

A separate steady flow HEC-RAS model was developed to simulate flow in the proposed fish ramp (primary spillway modification). This model used the detailed cross section geometry that includes a series of rock weirs. Roughness height of 1' was used for the entire fish ramp, and expansion and contraction coefficients were set at 0.3 & 0.1 respectively. Roughness height was chosen over a Manning's N-value roughness definition for the modeling as it better accounts for increased friction losses during low flows. A roughness height of 1' results in an equivalent N-value between 0.032-0.042 for flow depths greater than 1'. Sensitivity analysis was performed on the roughness, contraction, and expansion parameters and it was determined that their effect on the values were relatively minor in terms of their affect on the with-project pool duration curve.

The fish ramp model was also used to estimate the velocities for the range of flow conditions in order to meet criteria for fish passage and to select a size for the base stone for the ramp. A schematic of the proposed fish ramp spillway as well as the modeled family of rating curves for the modified outlet structure is shown in Plates 14 and 15.

10. Frequency Inflow Hydrographs.

Marsh Lake summer-time (May – September) inflow hydrographs for more frequent events (2, 5, 10, 25, 50, and 100 year return periods) were estimated for the purposes of this feasibility study. The estimate was obtained by taking the shape of the unit hydrograph for the Lac Qui Parle Reservoir (from Reference 2) and adjusted for drainage area using a simple ratio. The peak inflow frequency at Marsh Lake was determined by adjusting the 2, 5, 10, 25, 50, and 100 year flows at the Lac Qui Parle River and Pomme de Terre River Gages for to the entire Marsh Lake watershed based on a direct drainage area ratio; and then taking an average of the results of the two gages as the adopted Marsh Lake inflow frequency curve. The all-year inflow frequency curve was then adjusted for summer-only (May-September) using a ratio of 0.386 obtained from the ratio of the sum of all-year peaks to the sum the summer peaks at the Pomme de Terre River gage based on the record from 1931 to 1997. The final inflow hydrographs were calculated as a ratio of the Marsh Lake inflow unit hydrograph such that the peak inflow is equal to the peak inflow frequency. The information was used for the preliminary sizing of the stop-log drawdown structure to insure that water level goals can be obtained when the lake is occasionally drained. The graphic plots of the adopted frequency inflow event and their derivation are shown in Plates 8-11.

The 1% annual chance inflow hydrograph (shown in Plate 11) was also computed in a similar fashion and used to simulate existing and with project peak pool elevations on Marsh Lake, resulting in an existing peak inflow of 16,655 cfs and a peak inflow of 11,372 cfs under with project conditions.

11. Partial Duration Flow Frequency Curve for Pomme de Terre River.

A partial duration frequency analysis was done for this feasibility study based on the period from 1936 to 2007. The analysis will aid in the estimation of bankfull flow for the Pomme de Terre River in the vicinity of Marsh Lake and in consideration of stream restoration alternatives. Bankfull flow is taken to be approximately equal to a 1.5 year flood, or 850 cfs.

Exceedance Probability (%)	Return Period (years)	Flow (cfs)
0.1	1000	18778
0.2	500	14319
0.5	200	9729
1	100	7072
2	50	5223
5	20	3380
10	10	2420
20	5	1746
30	3.33	1383
40	2.5	1202
50	2	1056
60	1.67	928
70	1.43	809
80	1.25	731
90	1.11	636
95	1.05	587
99	1.01	528

Table 6. Results of Partial Duration Flow Frequency analysis for Pomme De Terre River at Appleton

12. Estimated Sediment Yield from the Pomme De Terre River Watershed.

Sediment yield for the Pomme De Terre River was estimated by utilizing the existing USGS suspended sediment data from the neighboring Chippewa River gage at Milan, MN. The annual sediment yield at Milan was calculated and adjusted to the Pomme de Terre River based on drainage area. A total average annual suspended sediment load from the Pomme De Terre River was estimated to be 13,200 cubic yards per year. It is noted that estimates of the rate of sediment deposition in Marsh Lake cited in "Water Control Manual, Lac Qui Parle Project, August 1995" are significantly higher than the rate suggested by the Chippewa River gage.

Annual Sediment Yield Chippewa River Near Milan, MN						Adjusted to Pomme De Terre River
Flow-Duration			Water	Sediment	Daily Yield	
Q Exceed.	Mid Ordin.	Increment	Q_w (cfs)	Q_s (tons/day)	Q_s (tons/day)	
0.0%						
	0.05%	0.1%	9,600.0	4,014.4	4.0	
0.1%						Drainage Area of Pomme De Terre River **905 sq. mi.**
	0.30%	0.4%	4,820.0	1,807.8	7.2	
0.5%						
	1.00%	1.0%	2,990.0	1,040.0	10.4	Drainage Area of Chippewa River **1870 sq. mi.**
1.5%						
	3.25%	3.5%	1,771.0	567.1	19.8	
5.0%						
	10.00%	10.0%	1,000.0	292.6	29.3	Average Annual Load from Pomme De Terre --Adjusted for Drainage Area **13221 C.Y. / year** **8.8 Acre-ft / year**
15.0%						
	20.00%	10.0%	581.0	156.0	15.6	
25.0%						
	30.00%	10.0%	360.0	89.6	9.0	
35.0%						
	40.00%	10.0%	232.0	53.9	5.4	
45.0%						
	50.00%	10.0%	159.0	34.8	3.5	
55.0%						
	60.00%	10.0%	101.0	20.6	2.1	
65.0%						
	70.00%	10.0%	65.0	12.4	1.2	
75.0%						
	80.00%	10.0%	38.0	6.6	0.7	
85.0%						
	90.00%	10.0%	19.0	3.0	0.3	
95.0%						
	97.50%	5.0%	5.0	0.6	0.0	
100.0%						
		Sum: Average Daily Sediment Load			108.5	Tons / day
		Average Annual Sediment Yield			**39,593**	Tons / year
					27,319	C.Y. / year

Table 7. Estimate of Average Annual Sediment Load to Marsh Lake from the Pomme De Terre River based in nearby gage site

Source	Result
University of Minnesota Study	105 cm deposited near mouth of Pomme De Terre River in Marsh Lake since construction of Marsh Lake Dam (~30 years). Study done prior to removal of Appleton Mill Dam.
Observed Sediment Rate for Big Stone River	0.05 acre-ft per sq. mi.
Chippewa River at Milan data translated to Appleton	8.8 acre-ft per year

Table 8. Summary of Sediment Load Estimates for Marsh Lake

13. Wind Speed and Direction Frequency and Duration Analysis.

Analysis of the wind speed and direction was performed on data obtained for the nearby Montevideo airport in order to support the utilization of aquatic plant growth modeling for Marsh Lake. Graphical plots of the results of the wind analysis are shown in Plates 12-13.

IV. Project Feature Alternatives: Design

14. Primary Spillway Modification.

The concept for the modification to the primary spillway includes a rectangular notch cut into the existing concrete ogee crest, a sloping rock fill base on the downstream side of the structure, and a series of arched bolder weirs. These features will have the effect of creating greater water level variability, lowering the average water level and allowing for fish passage between the Minnesota River and Marsh Lake.

a. General Layout of Spillway Notch, Rock Ramp, and Boulder Weirs

The specific layout and geometry of the features were optimized to achieve target water levels in Marsh Lake and velocities in the fish way. Optimization was done utilizing a HEC-RAS (steady flow) model of the fish ramp to establish a family of rating curves for the range of head and tail water conditions, and a separate HEC-RAS (unsteady) model to simulate water levels for 20 years of water level data (1983 – 2003).

Although the establishment of the fishway rating curves is complicated by the lack of calibration data, there will be an opportunity during construction to field fit the boulder weirs to achieve the desired hydraulic performance. Modeled hydraulic performance curves, are shown in Plate 14.

Design data for the dam modification is shown below in Table 9 and a figure detailing the design is shown on Plates 15-16.

Primary spillway modification: Design data	
Elevation of Existing Spillway Crest	937.6
Elevation of "notch"	935.5
Width of "notch"	30'
Invert of V-notch at Station 0+20 (d/s of crest)	936.0
Width of V-notch in base rock fill	30'
Slope of rock fill base (starting at Station 0+20)	4%
Number of boulder weirs	9
Spacing of weirs	20'
Vertical drop of each weir	0.8'
Diameter of individual weir boulders	5'
Number of boulders per weir	~34
Spacing between boulders along weir	0' (side by side)
Boulder "stick-up" above rip-rap base: (Min.-Max.)	1' – 3.5'
Upstream Angle Weir Intersection with bank	30°

*Elevations in NGVD 1929 Datum

Table 9. Primary Spillway Modification Design

b. Rip Rap Base Sizing

The rock fill base of the fish ramp will be subject to high velocities and must be constructed of material that resists erosion under the critical condition. The tail water condition at

Marsh Lake is controlled by the Lac Qui Parle Reservoir and does not necessarily submerge the dam at all higher flows. The minimum tail water elevation therefore was estimated based on a 20 year period for the tail water at the dam (1983-2003). Under the minimum tail water condition, average channel velocity for the full range of flows was determined using HEC-RAS (fish ramp model described in Section 9) and D50 riprap size was determined using criteria from HDC 712-1 (high turbulence and gamma of 165 lb/ft^3). Required D50 based on a spherical diameter is 1.6'.

Spillway Flow	Min. TW	Velocity Channel	HDC 712-1 D_{50} (ft)
1000	934	7.9	0.79
2000	936	9.3	1.09
3000	937	10.2	1.32
4000	938.5	10.7	1.47
5000	**941.5**	**11.2**	**1.60**
6000	942.5	8.8	0.98
7000	943.25	8.3	0.89
8000	944	8.1	0.83
10000	945	8.4	0.90
12000	946	8.7	0.96

Table 10. Determination of Critical Condition for Rip Rap Design

c. Fishway Containment Dikes

The rock-ramp fishway must include containment dikes along the left and right banks so as to contain all of the flow leaving the primary spillway within the fishway. For the purposes of the feasibility study, the top of the dikes will tie into to embankment at approximately 946.0' (NGVD 1929) and slope downstream at 4%.

d. Velocity Conditions for Fish Passage

Average velocities in the center (V-notch) of the fish ramp as well as in the sides of the ramp at the restrictive boulder weir cross sections were computed for a range of flow conditions and the results are shown in Table 11. Actual point velocities are expected to be lower than the average velocity especially in the sides where depth varies considerably.

Flow Rate (cfs)	Exceedance Duration	Average Velocity in center, V-notch of channel (ft/s)	Average Velocity in sides of channel (ft/s)
15	90%	3.12	0.26
175	50%	5.23	3.12
1500	10%	8.66	5.19

Table 11. Average velocities in fish ramp at the weir cross sections

15. Overflow Spillway Modification

The concept for modification of the Marsh Lake Dam overflow spillway consists of a series of stop-log bays with a concrete sill at elevation 935.0 (NGVD 1929 datum), with a top of stop log elevation of

940.0 (NGVD 1929 datum). The structure will allow for the periodic removal of the stop logs to achieve a water level drawdown while maintaining full spillway capacity for flood events.

a. Drawdown Structure Width

The desired minimum drawdown lake level is 935.0 (NGVD 1929). The criteria for selection of stop log bay size is based on (1) a maximum duration of bounce in the water surface for a 5-year summer storm (less than 7 days above 936.0), and (2) a maximum time to drawdown from average water surface elevation (938.3) to drawdown elevation (935.5) of about 15 days.

Preliminary routing simulations, as shown in Table 12, suggested that a total effective weir width of approximately 70′ will meet the necessary criteria. To insure a conservative feasibility level design; a width of 90′ was carried forward for the sizing of the drop structure and outlet channel.

Width of Drawdown Outlet	Equilibrium Flow (cfs)	5-yr Rainfall: duration of bounce (above 936.0′)	Maximum Water Surface During Bounce	Time to Drawdown (938.3 to 936.0)
20′	180	19.5 days	937.33	~54 days
40′	350	12 days	936.88	~36 days
60′	520	7.5 days	936.57	9 days
70′	605	6 days	936.45	6.75 days
80′	685	5 days	936.36	5.5 days
90′	770	4 days	936.28	4.5 days
Assumptions used for Feasibility Sizing:		Primary Spillway has 5′ wide notch at 935.5′ and sloping boulder fill Pomme de Terre has been rerouted and does not flow into the reservoir Sill of drawdown structure is at 934′ Weir coefficient for drawdown structure is 3.0 Tailwater in Lac Qui Parle Reservoir is 935.0′ Mean Inflow during drawdown is 375 cfs Inflow hydrograph for "bounce" has peak flow of 560 cfs		

Table 12. Feasibility Level Sizing of Drawdown Structure

b. Approach Channel

The sill elevation of the drawdown structure was selected as 935.0′ based on the lake bed bathymetry in the lower end of Marsh Lake. The sill will be set very near to the bottom of the lake bed, and the lake bed may limit the discharge through the structure when the stoplogs are removed. At this sill elevation, no approach channel dredging will be required. Some scour of the lake bed would be expected while the stop logs are removed. A map of bathymetry near the outlet is shown in Plate 17.

c. Drawdown Structure Configuration

A typical drop structure as defined in US Army Corps of Engineers Engineering Manual 1110-2-1601, Plate B-48 (Hydraulic Design of Flood Control Channels) was utilized as the basis for the design. The typical design is altered to allow for removable stop logs. A full pool elevation of 950' and a width of 90' were used for design, resulting in a design flow of 8500 cfs. Design calculations and structure dimensions are shown in Plate 18 and in Figure 2 below.

A large panel will be included in the design rather than individual stop logs, and will be constructed of aluminum. They will be less apt to seize in place and will eliminate the problem of trying to pull the lower stop-logs out from under water. A secondary/backup stop-log slot and spare panels will be included in the design in order to provide redundancy in case of failure. Although the panels will be removed about once every 10 years, they may need to be exercised every few years

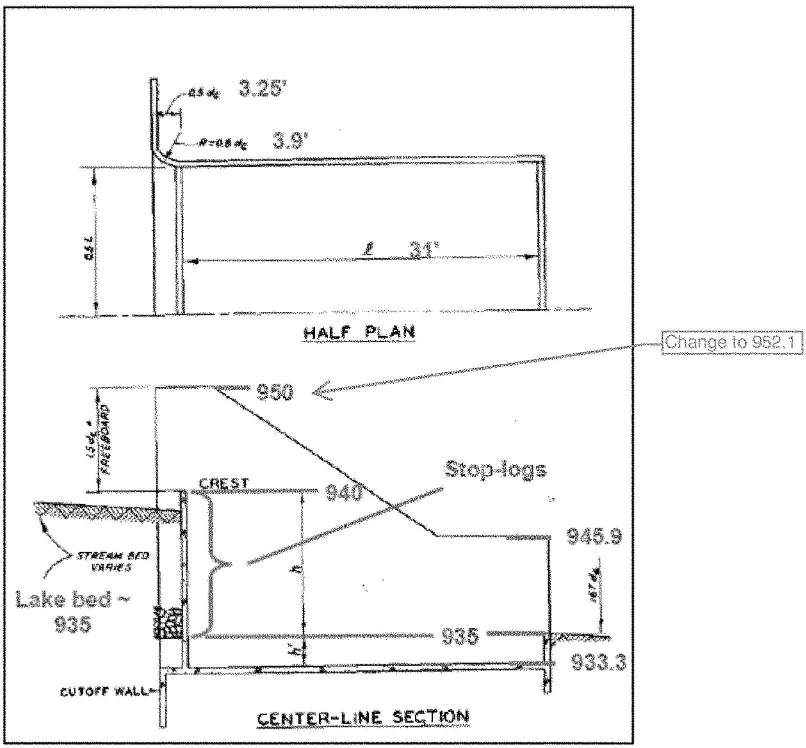

Figure 2. Preliminary design of auxiliary spillway/drawdown structure.

d. Outlet Channel Downstream of Drawdown Structure

The outlet channel will convey water from the drawdown structure to the Minnesota River. The channel will be lined with rip rap to prevent scour. For the design flow of 8500 cfs, a channel width of 90 feet, and Manning's n-value of 0.04, the maximum downstream channel slope to maintain sub-critical flow is approximately 2.75%. The slope must be reduced substantially to minimize the channel velocities and the size of rip-rap required for erosion protection.

The outlet channel will be protected from scour by rip-rap. The detailed design of the channel will be completed in next phase of design.

The minimum ration of radius of curvature to width of 3 is set for outflow channel, using the criteria in EM 1110-2-1601, Section 2-5-c.

e. Frequency of Operation

Duration analysis of the modeled water levels on Marsh Lake for the 20 year period (1983-2003) indicates that pool will reach elevation 940.0' or greater about 12-13% percent of the time during non-drawdown conditions (i.e. stop logs in place). This duration is not significantly altered under with-project conditions.

16. Embankment Sections

Two new sections of embankment are needed to separate the Marsh Lake pool from the rerouted section of the Pomme De Terre River. One of these sections must intersect the current Pomme De Terre River channel. Locations of these embankments are shown in Plate 19.

a. Selection of Design Elevations

The existing Spillway Design Flood (SDF) routed through the existing Marsh Lake dam and resulted in a peak pool elevation of 947.1' *(as determined in Reference 3). The design elevation for the new embankment sections shall include 5' of freeboard above the SDF routing, or an elevation of 952.1'.

Rip-rap protection against wave action is necessary for the lake side of new embankments. Top elevation of the rip-rap layer is assumed be equal to that of the existing embankments, which is 942.0'.

17. Diversion Plug

A diversion plug is needed to divert the Pomme De Terre River into its historic channel in the area upstream of the Marsh Lake Dam. The location of this plug is identified in Plate 19.

a. Selection of Design Elevation

The top elevation of the plug was chosen as 944.0 (NGVD 1929) in order to allow overtopping during floods and allow the river reach to mimic natural geomorphic processes. The plug will be situated in a ~200' reach of the existing Pomme de Terre river channel. The plug has a top-width that fills the much of this area, which will convert the area to terrestrial habitat.

18. Fish Pond Breach

An abandoned fish rearing pond exists downstream of the Marsh Lake Dam embankment. The embankment of the pond (which is separate from the main Marsh Lake Embankment) will be breached with the goal of allowing the area to periodically flood. A bottom elevation of the breach of 936.0 (NGVD 1929), which is expected to flooded by the tail water about 20% of the time, was selected.

19. In-Lake Breakwater Structures

A series of in-lake rock breakwater structures are included in the design features with the intent of reducing wind fetch and wave induced bottom sediment resuspension, in turn promoting water clarity and improving the conditions for aquatic plant growth.

a. Layout

The proposed layout of the rock breakwaters was done primarily by examination of a weighted wind fetch map (shown in Plate 13) which took into account both the shape of Marsh Lake and the frequency of wind directions in the region. The proposed locations of the breakwater structures are shown in Plate 20.

b. Typical Section

The breakwater structure elevation will be 2' above the average water surface elevation of 938.3 (NGVD 1929) or 940.3. A typical section of the breakwater structures is shown in Figure 1. A side slope ratio of 1V to 5H is recommended for structures that are subject to ice loading, which is the case for the proposed breakwater structures. Due to the ice load angular rock (quarry stone) is required for the structure.

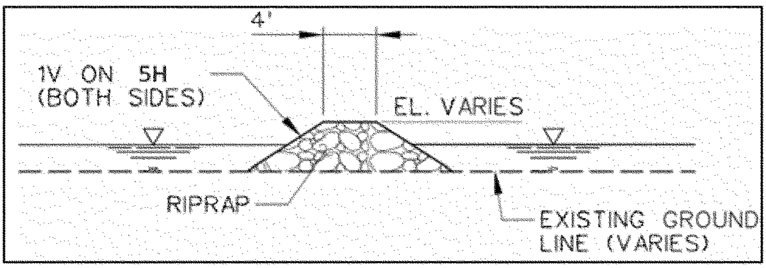

Figure 3. Typical section of in-lake breakwater structure

c. Aquatic Plant Growth Modeling & Optimization

Simulation of the conditions for aquatic plant growth based on reduced wind fetch in Marsh Lake is being conducted. During final design, this modeling will be available for use in the optimization of the breakwater structure layout.

20. Louisburg Grade Road Culvert Modifications

Several culverts connect the upper section of Marsh Lake to the main body of the lake through Louisburg Grade Road. Installation of stop log control structures at these locations in order to maintain higher water levels in the upper part of Marsh Lake during Marsh Lake water level drawdown are included in the design. The structures will provide the ability to maintain Upper Marsh Lake water levels up to the average water surface elevation of 938.3 (NGVD 1929).

21. Rerouting of the Pomme De Terre River

The lower section of the Pomme De Terre River was channelized as part of the original Marsh Lake Dam construction. The current project includes the restoration of this section of river by reconnecting the historic meandering channel. This project feature will include the construction of a bridge over the Pomme De Terre along the current embankment, the construction of two new sections of embankment (see section 16), the construction of a diversion plug (see section 17), some excavation along the historic channel, and erosion control structures.

As the historic channel was originally formed by the geomorphic conditions of the Pomme De Terre River and its watershed, it is expected that the channel plan form dimensions will result in a stable natural channel once the fine sediments are removed.

a. Approach to Construction

The reconnection of the Pomme De Terre to its historic channel will require some excavation of material that now blocks this flow path, particularly through the current embankment and near the mouth where it will meet the Minnesota River. It will also require that fill be placed in two channelized reaches of the current flow path. Some erosion control structures will also be necessary to prevent head cutting. However, the general philosophy will be to connect the river to its original flow path and allow natural processes to form to channel.

b. Stream Classification

The lower reach of the Pomme De Terre was classified according to the Rosgen stream classification system based on field surveys. The lower reach of the river below Appleton falls generally into the "C" class.

c. Bankfull Flow

The Pomme De Terre River below Appleton has a bankfull flow rate of approximately 850 cfs (see section 11).

d. Typical Channel Dimensions

Cross section surveys of the Pomme De Terre below Appleton, MN indicate that the average bankfull width of channel is approximately 90-110 feet. This width was verified with aerial photos. Steady flow modeling of the Pomme de Terre River with a bankfull discharge (850 cfs, see Section 11) shows that hydraulic depth varies from 3-5 feet in the reach between Appleton and the mouth. An average depth of 4' is therefore considered the typical depth for the Pomme Terre River in the project reach. Based on the stream slope upstream of the project area, a typical slope of 0.0005 ft/ft is considered representative of the reach to be restored. Typical side slopes are approximately 1V:6H.

e. Bridge Dimensions

The bridge over the Pomme De Terre River must have a low flow channel of the appropriate size to mimic natural geomorphologic process, and also have enough flow area such that it does not induce flooding upstream.

Preliminary bridge sizing was done using a low flow channel with a top with of 90', a depth 4.5', side slopes of 1V:3H, as well a overbank area as required to not induce an increase in stages greater than 0.5' upstream of the bridge for the 1% chance flood event. For preliminary sizing, the width of overbank required was calculated based on the results from the HEC-RAS model for a steady flow of 8000 cfs (1% chance flood), and increased until the upstream stage increase was less than 0.5'. Results of the preliminary sizing for the bridge are summarized below.

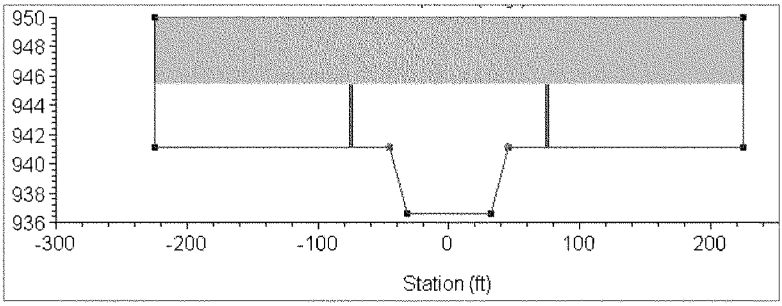

Figure 4. Cross Section View of Preliminary Bridge Design

Station	-225	-225	-45.5	-32	32	45.5	225	225
Elevation	950	941.1	941.1	936.6	936.6	941.1	941.1	950
				* *Bridge Deck Elevation = 950.0'* * *Low Chord of Bridge Elevation = 946.0'*				

Table 13. Station Elevation Data for Preliminary Bridge Design

f. Erosion Control Structures

In-channel erosion control structures will be necessary to insure that excessive head cutting does not take place in the new Pomme De Terre River channel, as it has the potential to threaten infrastructure. The concept for the erosion control structures, shown in Plate 21, consists on a series of small rock cross vane structures the lowest of which is to be placed near the mouth of the re-routed Pomme de Terre River, and the highest of which is located slightly upstream of the re-routed reach. The design of the structures is to be based on guidance from Reference 9 (Rosgen 2001).

V. Project Feature Alternatives: Impacts

22. Overall Impact on Marsh Lake Water Levels

The combined project features will alter the water level regime in Marsh Lake. The overall effect will be increased water level variability, minimal changes during flood events, and occasional managed water level drawdown. An HEC-RAS (unsteady) model was calibrated to simulate 20 years of water level data in Marsh Lake, and then used to simulate the "with-project" condition (dam modification & rerouting of the Pomme De Terre) and evaluate water level changes.

a. Average Water Levels

The water levels on Marsh Lake during non-flood scenarios are controlled by a combination of the inflows to the lake and the primary ogee crest outlet. The "with-project" conditions will alter the Elevation-Discharge relationship at the dam as well as reduce inflow to the lake by draining the Pomme De Terre River directly downstream into the Minnesota River. Existing & with project Elevation-Discharge curves for the primary outlet structure are shown in Plate 22.

	Existing	With Project
Annual 10% Exceedance	940.3	940.3
Annual 25% Exceedance	940.3	939.0
Annual Average	939.0	938.0
Annual 75% Exceedance	938.3	937.3
Annual 90% Exceedance	937.9	936.6
Minimum	937.7	936.0
September Average	938.1	937.7
September 90% Exceedance	937.7	936.8
April Average	939.9	940.0

Table 14. Summary of Existing and With Project Marsh Lake modeled water levels based on 20 years of lake levels (1983-2003)

b. Flood Impacts

<u>Upstream/Marsh Lake Pool</u>

The changes to large flood levels on Marsh Lake from the proposed project were evaluated with two methods:

(1) For water level simulations over 20 years (1983 – 2003), results for the two largest flood events (1997 & 2001) with & without project features were compared

and,

(2) Estimated 100 year flood hydrographs for with and without project conditions were routed through the reservoir.

Simulated with project water levels were on the order of 1.5' lower than modeled existing conditions for the 1997 & 2001 flood events. This is primarily attributed to reduced inflows to Marsh Lake due to the altered Pomme De Terre flow path. Note that the calibration of the HEC-RAS unsteady model focused on average water levels and that the calibration of the peak flows to the observed data was complicated by tailwater conditions controlled by the Lac Qui Parle dam. Despite this complication, the model gives a general estimate of the effect of the proposed project on Marsh Lake flood water levels.

Inflow hydrographs for the 100 year flood were estimated (as described in Section 5). The 100 year runoff was determined to be 1.06 inches, which resulted in a peak inflow of 16,655 cfs for existing conditions and 11,372 for with project conditions. Antecedent water level was 938.3 and tailwater was held at 935 (artificially low for a flood event) in order to make a direct comparison. The with-project routing resulted in a peak stage approximately 1.2' lower than existing conditions.

	1997 Peak	2001 Peak	1% inflow
Existing Observed	948.54	946.04	n/a
Existing Modeled	947.43	946.63	944.72
With Project Modeled	945.85	945.1	943.52
Difference	-1.58'	-1.53'	-1.2'

Table 15. Summary of Modeled Peak Pool Elevations for historic peaks, Existing vs. Project Conditions

In summary, this analysis shows that Marsh Lake is expected to experience lower peak flood elevations due to the project as designed in this feasibility study. Note that the current 100-year Pool Elevation on Marsh Lake of 947.4' is above the maximum pool elevation and is not relied upon for flood control downstream.

<u>Downstream/Lac Qui Parle & Montevideo</u>

The flood damage reduction benefits from the Lac Qui Parle Project are largely focused on the city of Montevideo and downstream to the City of Granite Falls. The project features consist of the Lac Qui Parle Dam (gated), the Chippewa Sag Diversion dam and weir (gated), downstream channel modifications, and Marsh Lake dam (un-gated). The Marsh Lake Dam, with its relatively low spillway crest and lack of operating gates, contributes relatively little actual flood control storage compared to the Lac Qui Parle Reservoir.

The HEC-RAS water level model, which routes inflows for the period of 1983-2003, shows only minor changes to the outflow from Lac Qui Parle Dam and stages at Montevideo. Depending on the timing and sources of inflows, the modeling indicates that the proposed project conditions may slightly decrease the water level at Montevideo for some flood events, and may slightly increase it for some flood events. The modeling shows changes on the order of +/- 0.1' at Montevideo.

The proposed project at Marsh Lake includes an overflow spillway with removable gates with the purpose of allowing occasional water level draw-downs of Marsh Lake for environmental purposes. Following a drawdown, Marsh Lake has the potential to provide a large amount of additional storage if the gates were to close during the flood event. This flood control benefit outweighs any perceived flood control dis-benefit resulting from the dam modification

23. Dam Safety

a. Selection of Appropriate of Hazard Potential Classification and Dam Safety Standard

Marsh Lake Dam has been classified in the National Inventory of Dams data base as a Low Hazard dam. Although no official classification of the Corps of Engineers Dam Safety Standard according to ER 1110-8-2 (FR) has been determined for Marsh Lake, it is likely a Standard 2. Dam Safety Standard 2 applies to structures with relatively small head differentials during floods and states that the dam must be able to safely pass major floods typical of the region.

b. Consequences of Marsh Lake Dam Failure

The consequences of failure at Marsh Lake Dam are relatively minor as it lies above the Lac Qui Parle Reservoir, which contains more storage than Marsh Lake. A flowage easement up to elevation 945 exists for the Lac Qui Parle Reservoir, and there is no population below that elevation.

Failure at Marsh Lake Dam during a flood event could cause an increase in the water level on Lac Qui Parle. The two largest recent flood events (1997 and 2001), the 1% Annual Exceedance Probability Event, and the 0.5% Annual Exceedance Probability Event were analyzed to determine the worst case condition on the Lac Qui Parle Reservoir (maximum pool level and maximum increase in stage) that would result from a failure of Marsh Lake Dam. The results, show in Table 16 below, show that the non-overflow section of the Lac Qui Parle Dam would not be overtopped for any of the scenarios.

Event	**1997**	**2001**	**Pool Frequency Curve**	
Annual Exceedance Probability	0.69%	1.54%	1%	0.50%
Marsh Pool Return Period	145 year	65 year	100 year	200 year
Marsh Pool	948.5	946	947.4	949.2
Marsh Storage (x 1,000 acre-ft)	123	88	106.9	134.2
LQP Pool	944.4	938	943.6	944.7
LQP Storage (x 1,000 acre-ft)	168.2	86	156.6	172.85
Combined Storage (x 1,000 acre-ft)	291.2	174	263.5	307.05
Marsh Lake Dam Failure: Worst Case Condition on Lac Qui Parle Reservoir				
Combined LQP & Marsh Lake Pool	946.3	941.8	945.4	946.9
Increase on LQP vs. Non-Failure	1.9	3.8	1.8	2.2
Remaining Freeboard at Lac Qui Parle (non-overflow embankment section)	2.2	6.7	3.1	1.6
Depth Above Flowage Easement (EL 945)	1.3	below	0.4	1.9
Estimated Loss of Life	0	0	0	0

Table 16. Potential for Increase in Lac Qui Parle Stages in the case of Marsh Lake Dam Failure

The Lac Qui Parle Reservoir can pass the Probably Maximum Flood (PMF) with 2' of freeboard. At larger events up to the PMF, Marsh Lake is already overtopped and poses no additional risk downstream if it were to breach.

c. Adequacy of Spillway and Freeboard at Marsh Lake Dam

Existing Conditions

The Probable Maximum Flood was determined in "Dam Failure Planning Report, Marsh Lake Dam, August 1987" using an all season storm with a peaking factor of 1.0. The PMF inflow hydrograph has a peak inflow of 109,000 cfs and the routing of the PMF through Marsh Lake, using an antecedent water level of 937.6' (NGVD 1929) resulted in a maximum pool elevation of 952.0' (NGVD 1929).

The Spillway Design Flood (SDF) as determined in "Dam Failure Planning Report, Marsh Lake Dam, August 1987" using a ratio of the Probable Maximum Storm (PMS) hyetograph to obtain a routing through Marsh Lake that produced a maximum stage of 947.1 (NGVD 1929) which allowed for the minimum of 3' of freeboard using an antecedent water level of 937.6 (NGVD 1929). The SDF inflow hydrograph has a peak flow of 21,000 cfs. Therefore, in terms of peak inflow to Marsh Lake, the SDF is less than 20% of the PMF for Marsh Lake.

Dam Safety Standard 2 requires that the dam be able to safely pass majors floods typical of the region. According to the pool frequency curve, the 100 year (1% annual exceedance probability) and 200 year (0.5% annual exceedance probability) pool elevations are 947.4 and 949.2 respectively. Using the minimum embankment elevation of 948.6, less than 2' of freeboard is available for the 100 year event, and the dam is overtopped for the 200 year event. It is unlikely that the dam meets current dam safety criteria under existing conditions.

With Project Conditions

Under "with-project" conditions, the drainage area into Marsh Lake will be reduced by approximately 30% from 2853 mi^2 to 1948 mi^2, which will have the effect of reducing the volume of flood inflows. The discharge capacity of the primary outlet will be subtly altered as the primary spillway will include more flow area for a given pool elevation, but have a lower discharge coefficient due to the effect of the fishway and boulder weirs. The capacity of the overflow spillway will also be subtly altered as discharge coefficient over the stoplogs will increase compared to the existing broad crested weir, but the introduction of stop log bay piers will reduce flow area. As shown in the analysis Section 22, the combined effect of project features will have the overall effect of decreasing the Marsh Lake pool elevation for large flood events.

In summary, the ability for the Marsh Lake Dam to safely pass the design flood event will be somewhat improved as a result of the proposed project.

VI. References

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4. Water Control Manual, Lac Qui Parle Project, August 1995

5. US Army Corps of Engineers Engineering Manual 1110-2-1601, Hydraulic Design of Flood Control Channels, July 1991

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8. US Army Corps of Engineers Engineering Regulation 1110-8-2 (FR), Inflow Design Floods for Dams and Reservoirs, March 1991

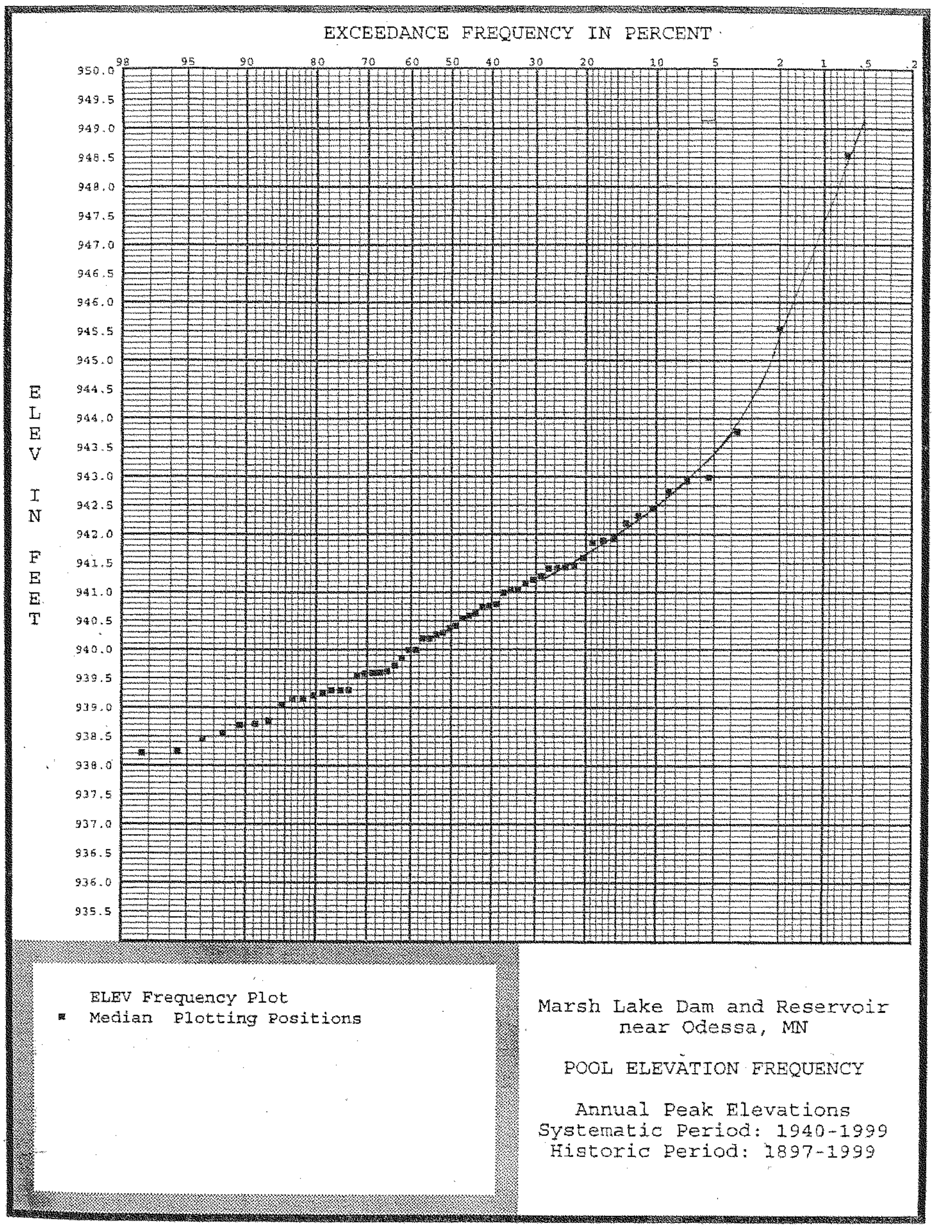
9. Rosgen, David, "The Cross-Vane, W-Weir and J-Hook Vane Structures...Their Description, Design and Application for Stream Stabilization and River Restoration", 2001

Marsh Lake Dam

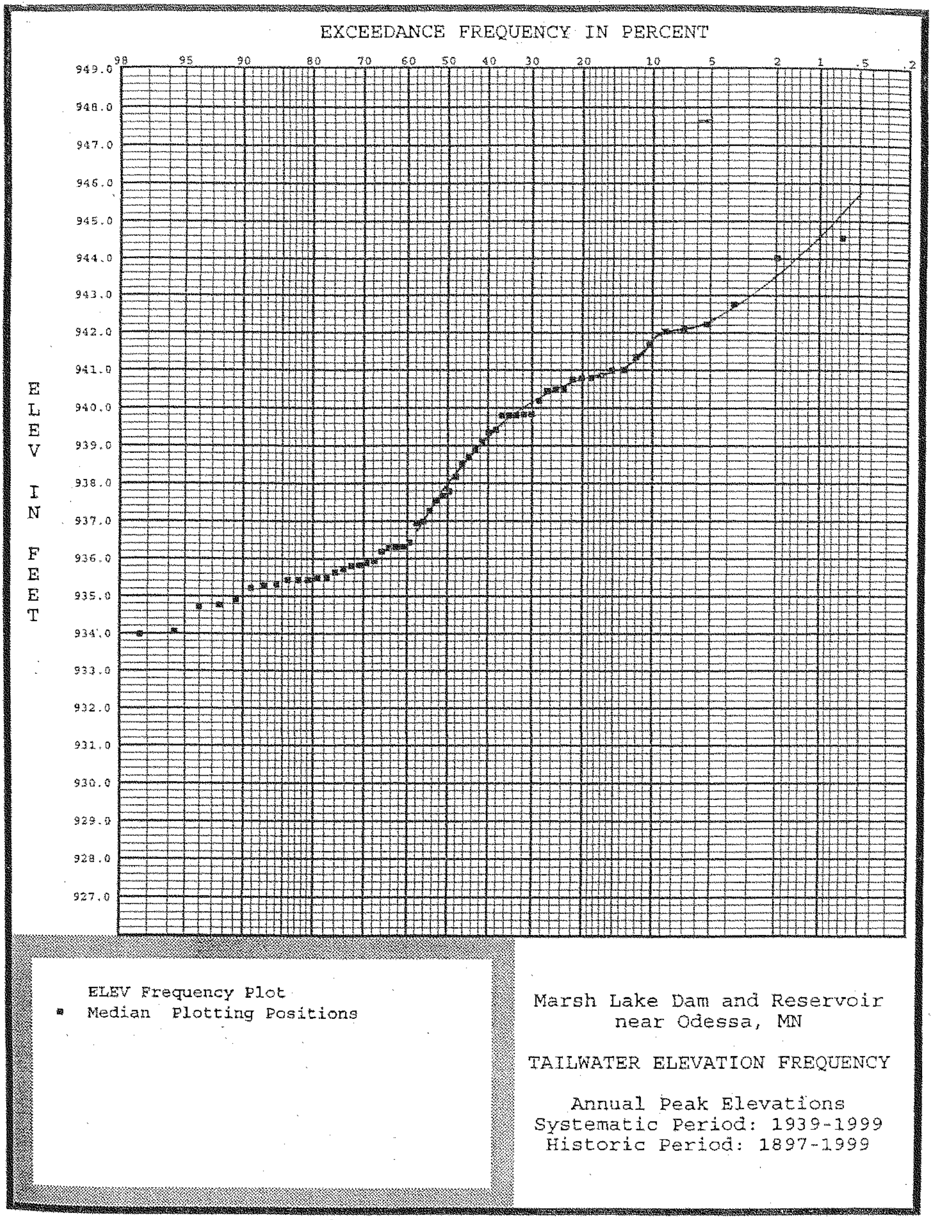
Ecosystems Restoration Feasability Study

H&H Appendix

PLATES



Hydrology & Hydraulics Appendix: Plate 1


EXCEEDANCE FREQUENCY IN PERCENT
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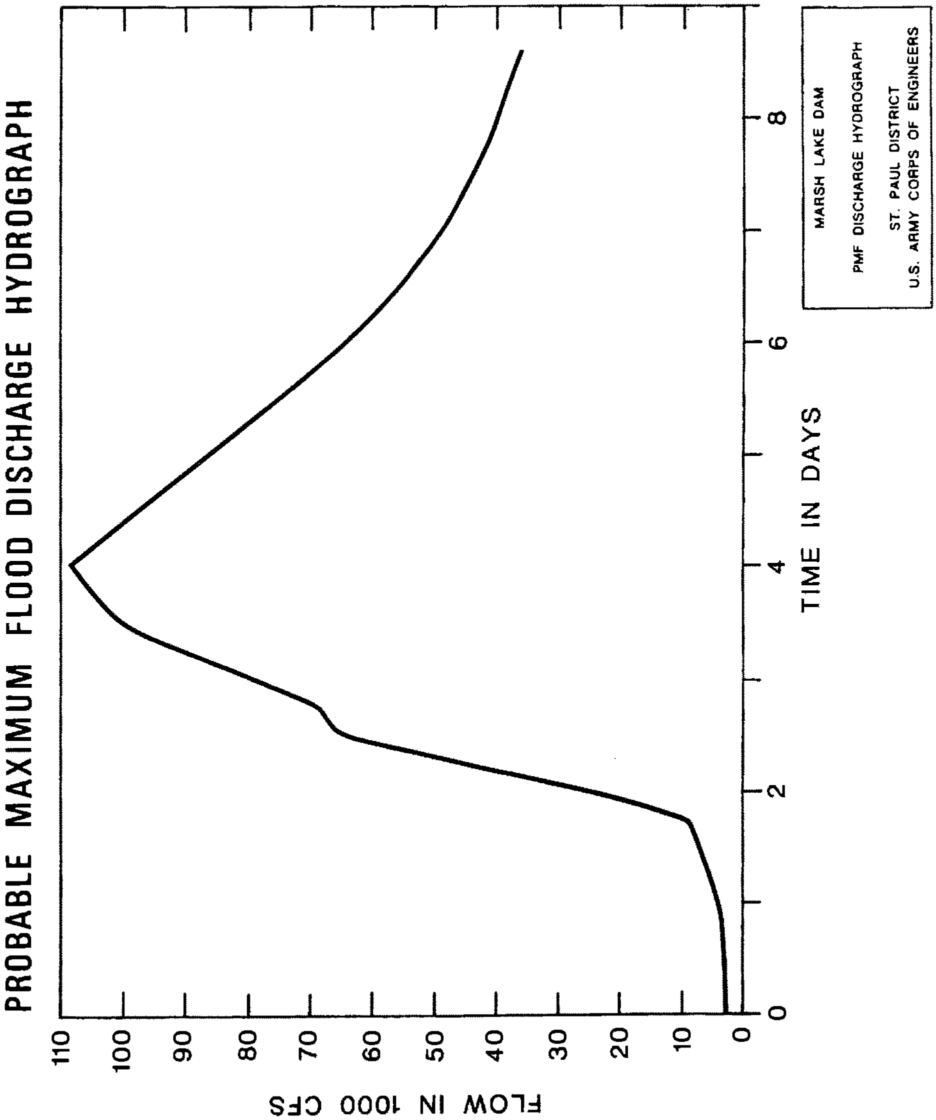
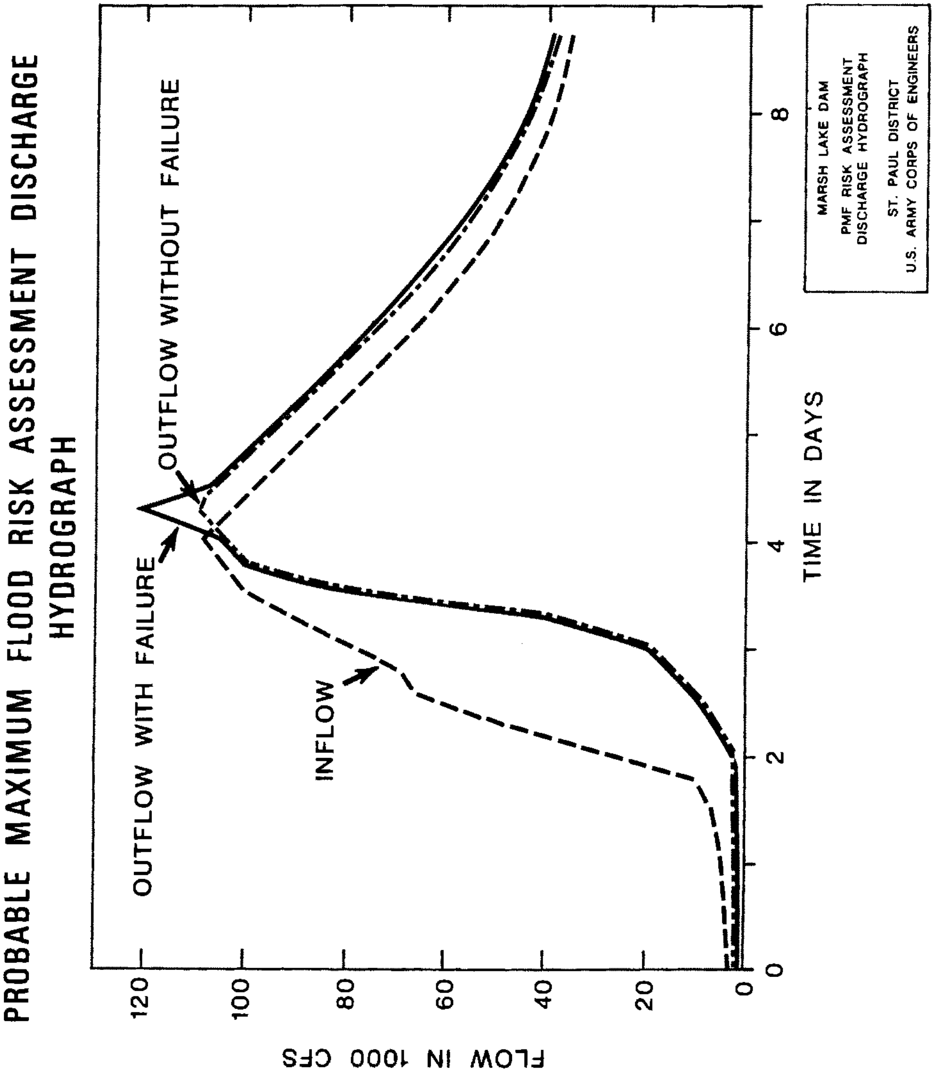
ELEV IN FEET
ELEV Frequency Plot
Median Plotting Positions
Marsh Lake Dam and Reservoir
near Odessa, MN
TAILWATER ELEVATION FREQUENCY
Annual Peak Elevations
Systematic Period: 1939-1999
Historic Period: 1897-1999



Hydrology & Hydraulics Appendix: Plate 3


PROBABLE MAXIMUM FLOOD RISK ASSESSMENT DISCHARGE HYDROGRAPH
OUTFLOW WITHOUT FAILURE
OUTFLOW WITH FAILURE
INFLOW
FLOW IN 1000 CFS
TIME IN DAYS
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40
60
80
100
120
0
2
4
6
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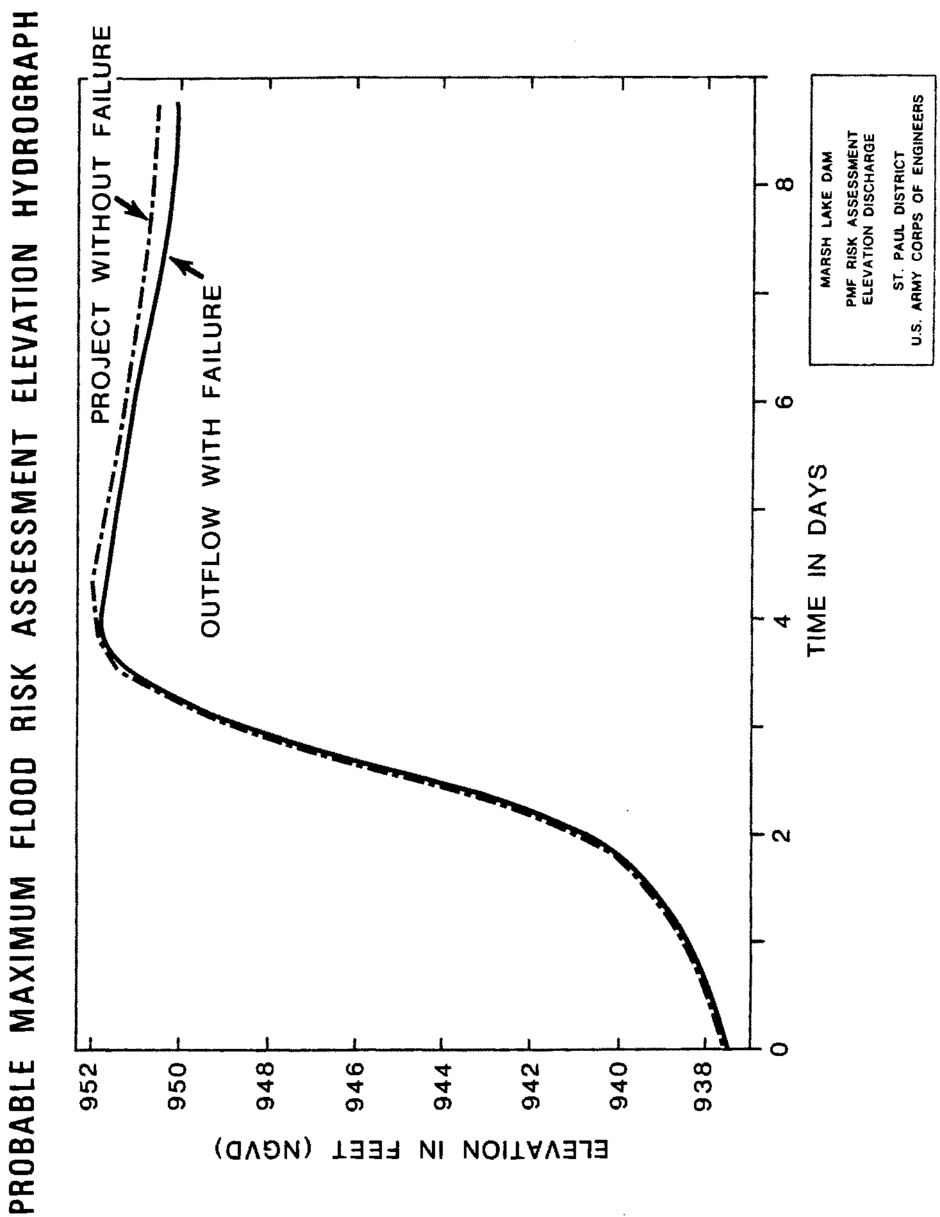
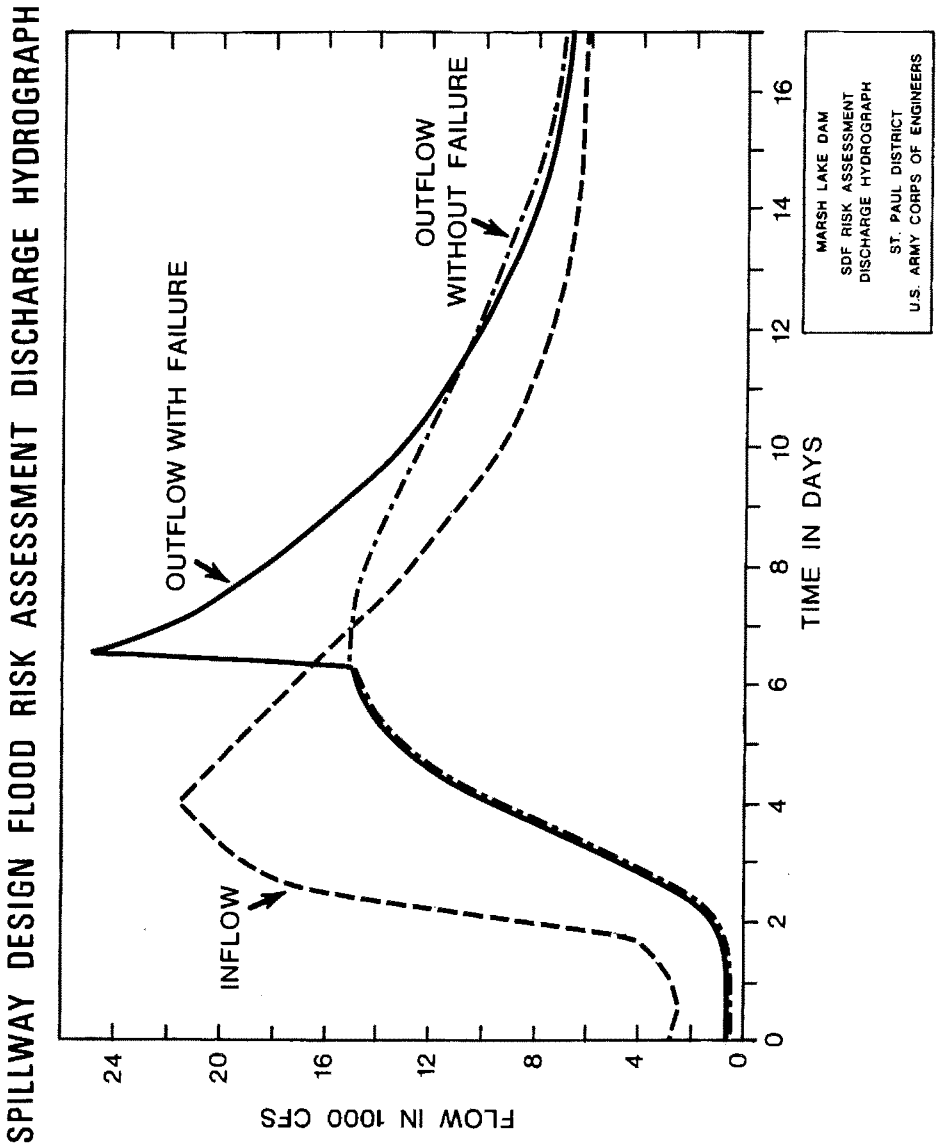
MARSH LAKE DAM
PMF RISK ASSESSMENT
DISCHARGE HYDROGRAPH
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS



Hydrology & Hydraulics Appendix: Plate 5


SPILLWAY DESIGN FLOOD RISK ASSESSMENT DISCHARGE HYDROGRAPH
FLOW IN 1000 CFS
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4
8
12
16
20
24
TIME IN DAYS
0
2
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6
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12
14
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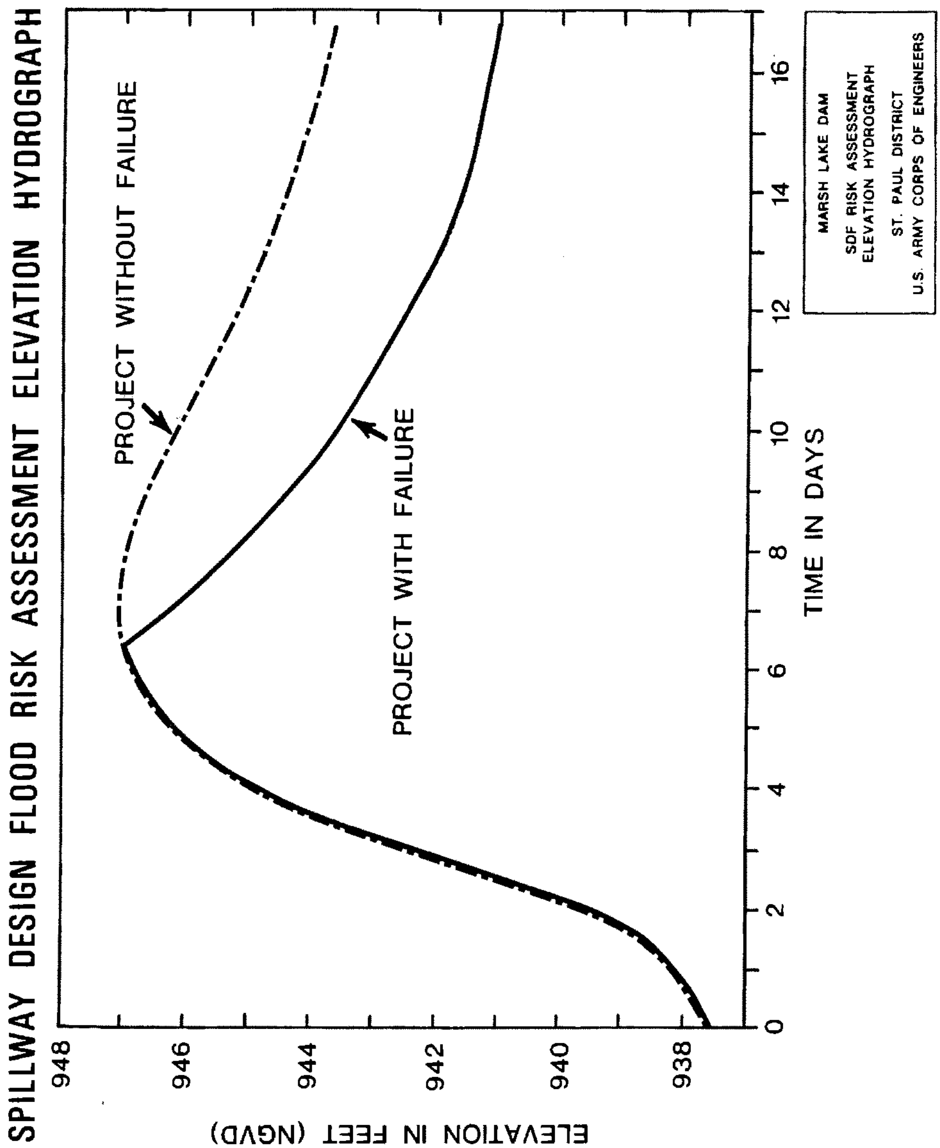
INFLOW
OUTFLOW WITH FAILURE
OUTFLOW WITHOUT FAILURE
MARSH LAKE DAM
SDF RISK ASSESSMENT
DISCHARGE HYDROGRAPH
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS


SPILLWAY DESIGN FLOOD RISK ASSESSMENT ELEVATION HYDROGRAPH
PROJECT WITHOUT FAILURE
PROJECT WITH FAILURE
ELEVATION IN FEET (NGVD)
948
946
944
942
940
938
TIME IN DAYS
0
2
4
6
8
10
12
14
16
MARSH LAKE DAM
SDF RISK ASSESSMENT
ELEVATION HYDROGRAPH
ST. PAUL DISTRICT
U.S. ARMY CORPS OF ENGINEERS

Determination of Unit Hydrographs For Marsh Lake Inflow
With and Without Project

12-hr Unit Hydrograph Lac Qui Parle Excluding Area above Big Stone Dam *from 1971 PMF Study of Minnesota River		Adopted 12-hr Unit Hydrograph Marsh Lake Reservoir (MN River U/S) based on Drainage Area Translation Existing Conditions		**Adopted 12-hr Unit Hydrograph Marsh Lake Reservoir (MN River U/S) based on Drainage Area Translation with Rerouted PDT**	
D.A. =	2890	D.A. =	2853	**D.A. =**	**1948**
		Drainage Area Factor = 0.987		**Drainage Area Factor = 0.674**	
Hour	Flow	Hour	Flow	**Hour**	**Flow**
12	630	12	622	**12**	**425**
24	1350	24	1333	**24**	**910**
36	2340	36	2310	**36**	**1577**
48	3700	48	3653	**48**	**2494**
60	5650	60	5578	**60**	**3808**
72	8100	72	7996	**72**	**5460**
84	11700	84	11550	**84**	**7886**
96	**15960**	96	**15756**	**96**	**10758**
108	15200	108	15005	**108**	**10246**
120	12650	120	12488	**120**	**8527**
132	10200	132	10069	**132**	**6875**
144	8400	144	8292	**144**	**5662**
156	7250	156	7157	**156**	**4887**
168	6300	168	6219	**168**	**4247**
180	5640	180	5568	**180**	**3802**
192	5100	192	5035	**192**	**3438**
204	4620	204	4561	**204**	**3114**
216	4200	216	4146	**216**	**2831**
228	3750	228	3702	**228**	**2528**
240	3380	240	3337	**240**	**2278**
252	3000	252	2962	**252**	**2022**
264	2620	264	2586	**264**	**1766**
276	2320	276	2290	**276**	**1564**
288	1980	288	1955	**288**	**1335**
300	1700	300	1678	**300**	**1146**
312	1480	312	1461	**312**	**998**
324	1280	324	1264	**324**	**863**
336	1100	336	1086	**336**	**741**
348	950	348	938	**348**	**640**
360	800	360	790	**360**	**539**
372	710	372	701	**372**	**479**
384	560	384	553	**384**	**377**
396	400	396	395	**396**	**270**
408	280	408	276	**408**	**189**
420	200	420	197	**420**	**135**
432	100	432	99	**432**	**67**

Determination of Peak Inflow Frequency for Marsh Lake

Flow Frequency at Pomme de Terre Gage
Drainage Area = 905 mi²

Event	Flow	Flow Adjusted for Marsh existing DA = 2853 Ratio (2853/905) = 3.15	Flow Adjusted for Marsh w/o PDT DA = 1948 Ratio (1948/905) = 2.15
2-yr	704	2219	1515
5-yr	1470	4634	3164
10- yr	2130	6715	4585
25-yr	3140	9899	6759
50-yr	4010	12641	8631
100-yr	4980	15699	10719

Flow Frequency at Lac Qui Parle Gage
Drainage Area = 4050 mi²

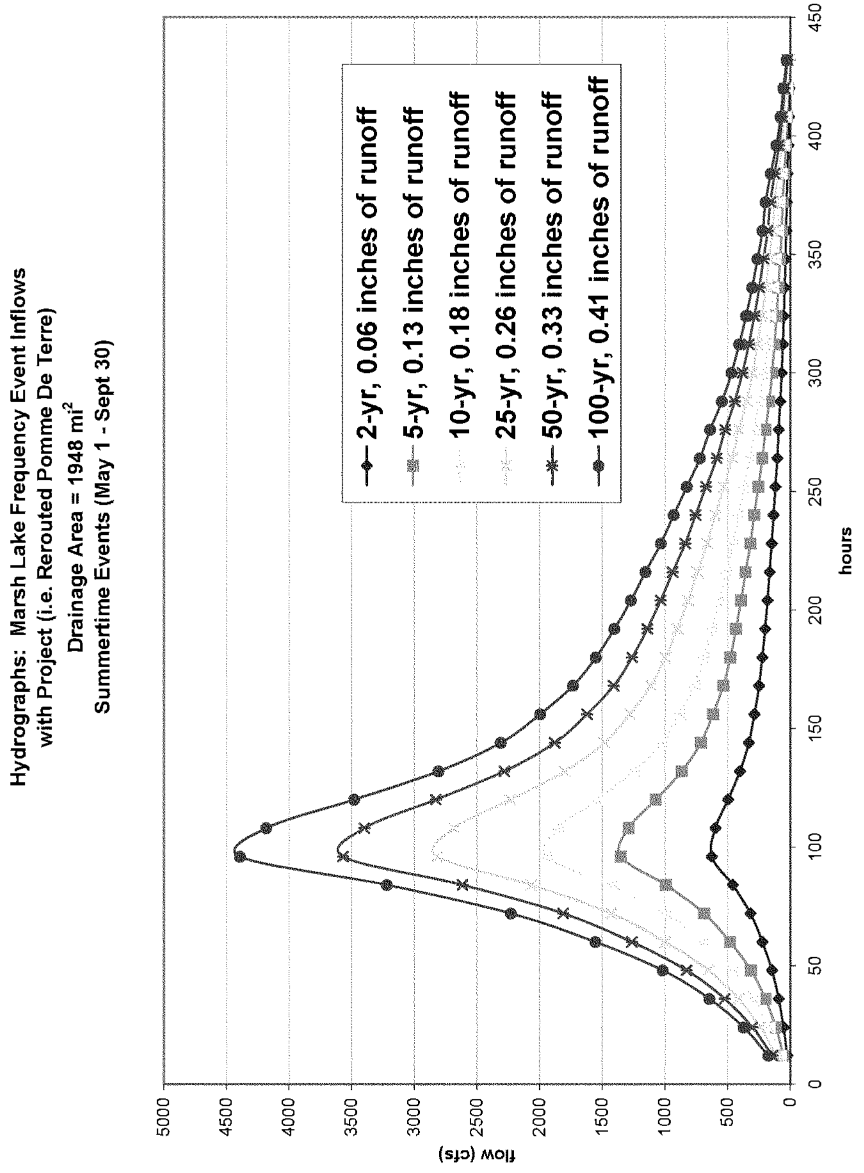
Event	Flow	Flow Adjusted for Marsh existing DA = 2853 Ratio (2853/4050) = 0.70	Flow Adjusted for Marsh w/o PDT DA = 1948 Ratio (1948/4050) = 0.48
2-yr	3600	2536	1732
5-yr	8000	5636	3848
10- yr	11400	8031	5483
25-yr	16300	11482	7840
50-yr	20500	14441	9860
100-yr	25000	17611	12025

Adopted Inflow Frequency Estimate For Marsh Lake
Average of Estimates from Translations from Two Nearby Frequency Curves

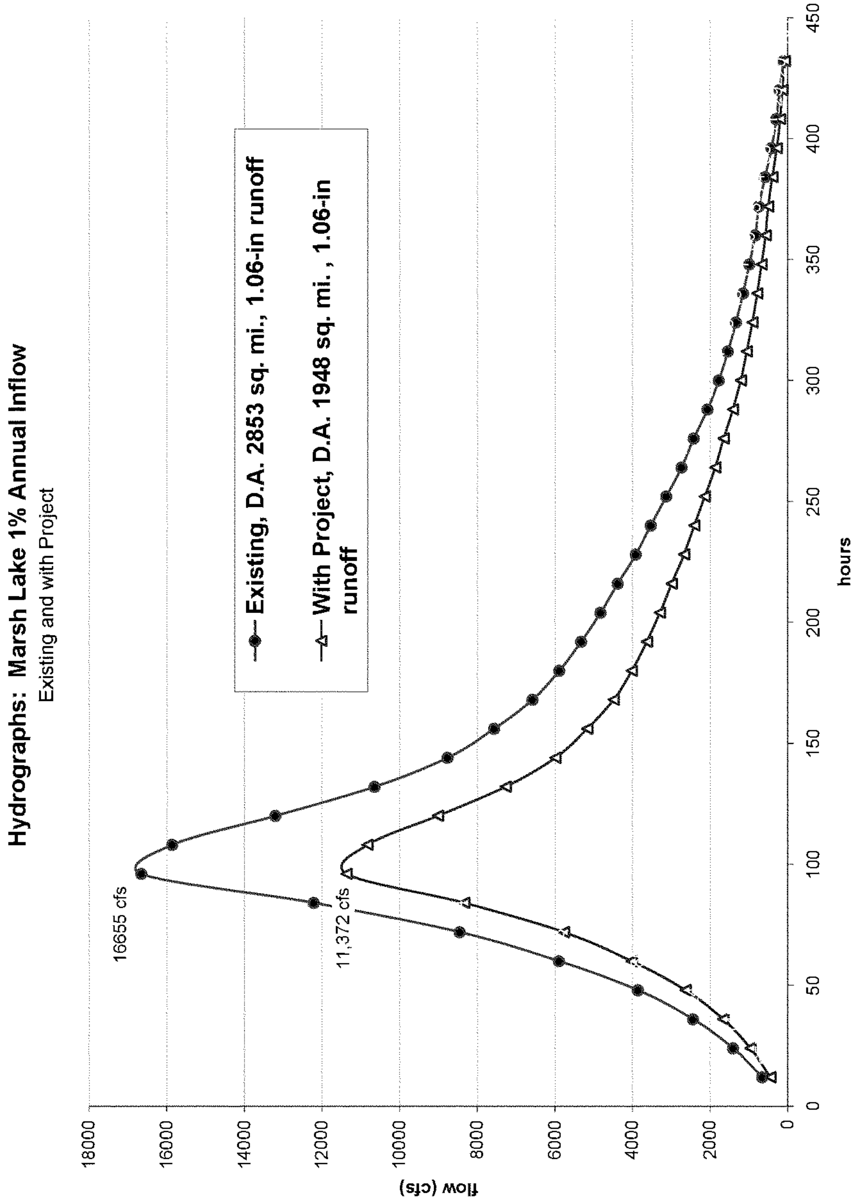
Event	Marsh Lke Inflow w/o PDT DA = 1948	Marsh Lake Inflow existing DA = 2853	Inches of Runoff
2-yr	1623	2378	0.15
5-yr	3506	5135	0.33
10- yr	5034	7373	0.47
25-yr	7299	10691	0.68
50-yr	9246	13541	0.86
100-yr	11372	16655	1.06

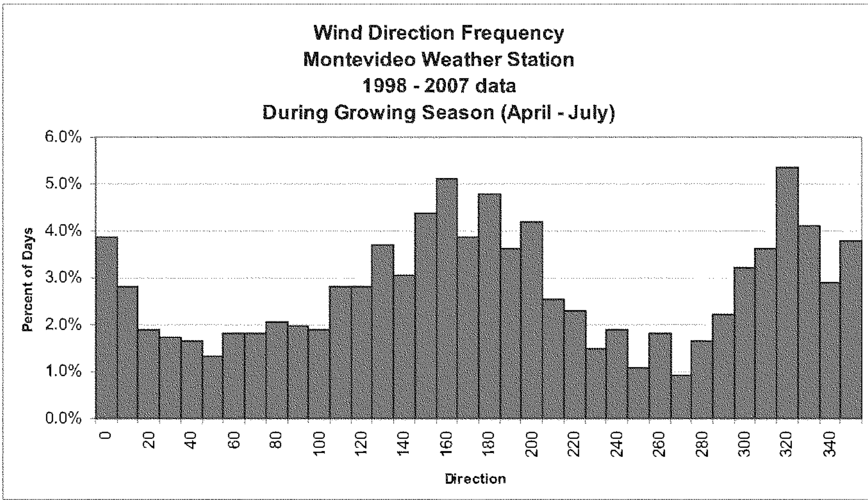
Adopted Summer (May-Sept) Frequency Estimate for Marsh Lake
Based on ratio of Annual to Summer Peak flow from (1931-1997)
Ratio = 0.386

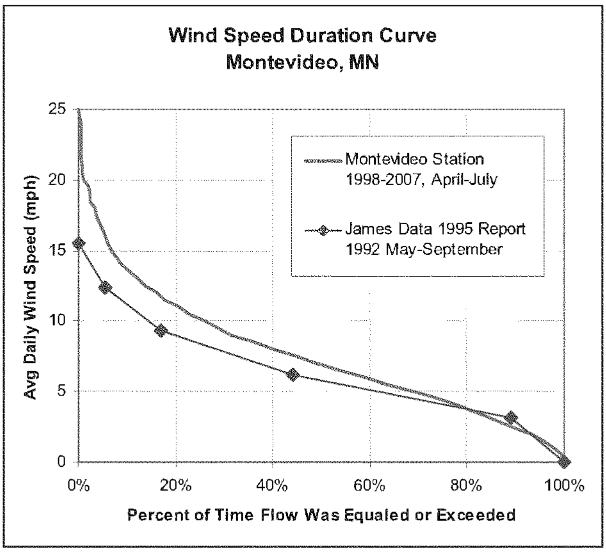
Event	Marsh Lke Summertime Inflow w/o PDT DA = 1948	Marsh Lke Summertime Inflow existing DA = 2853	Inches of Runoff
2-yr	627	918	0.06
5-yr	1353	1982	0.13
10- yr	1943	2846	0.18
25-yr	2818	4127	0.26
50-yr	3569	5227	0.33
100-yr	4390	6429	0.41

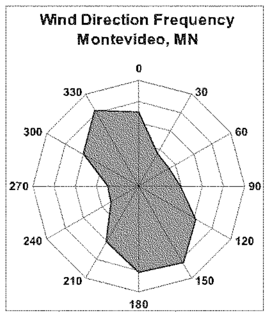


Hydrology & Hydraulics Appendix: Plate 10


Hydrographs: Marsh Lake 1% Annual Inflow
Existing and with Project
Existing, D.A. 2853 sq. mi., 1.06-in runoff
With Project, D.A. 1948 sq. mi. , 1.06-in runoff
16655 cfs
11,372 cfs
flow (cfs)
hours
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
50
100
150
200
250
300
350
400
450

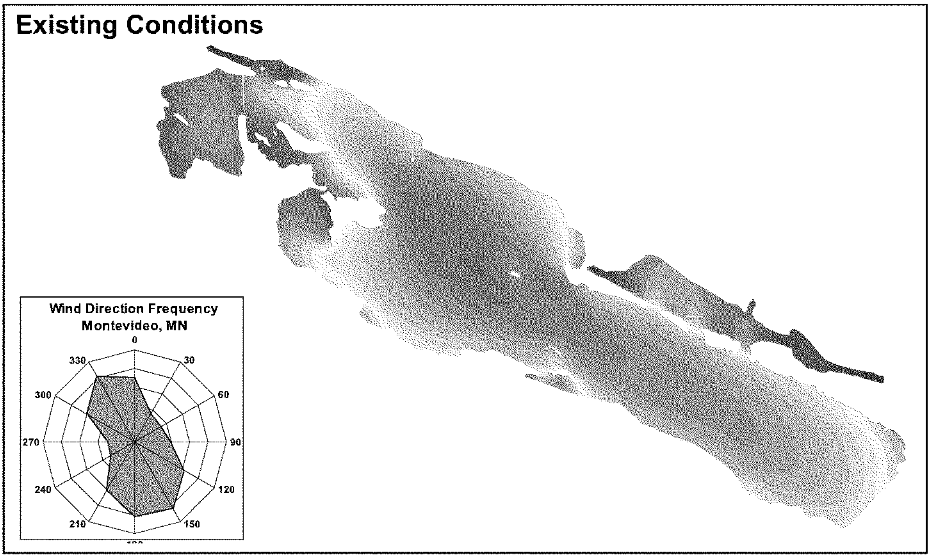

Wind Direction Frequency
Montevideo Weather Station
1998 - 2007 data
During Growing Season (April - July)
Percent of Days
6.0%
5.0%
4.0%
3.0%
2.0%
1.0%
0.0%
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
Direction

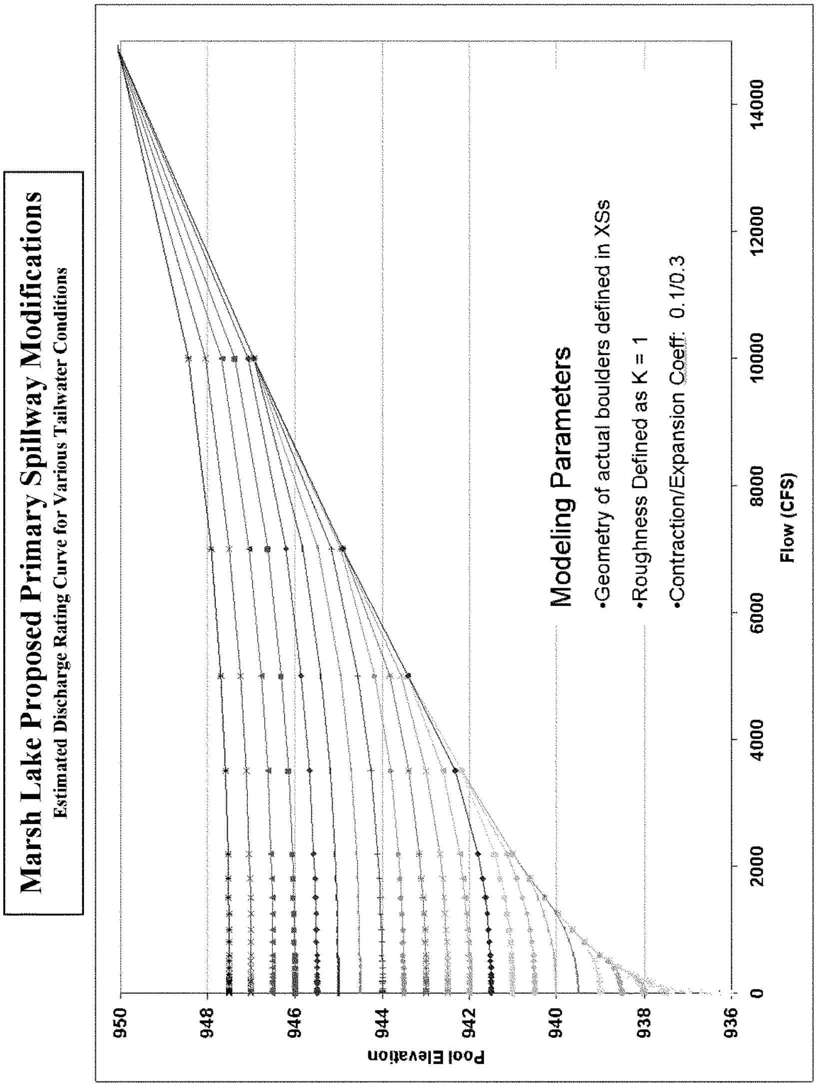

Wind Speed Duration Curve
Montevideo, MN
Avg Daily Wind Speed (mph)
25
20
15
10
5
0
0%
20%
40%
60%
80%
100%
Percent of Time Flow Was Equaled or Exceeded
Montevideo Station
1998-2007, April-July
James Data 1995 Report
1992 May-September


Wind Direction Frequency
Montevideo, MN
0
30
60
90
120
150
180
210
240
270
300
330

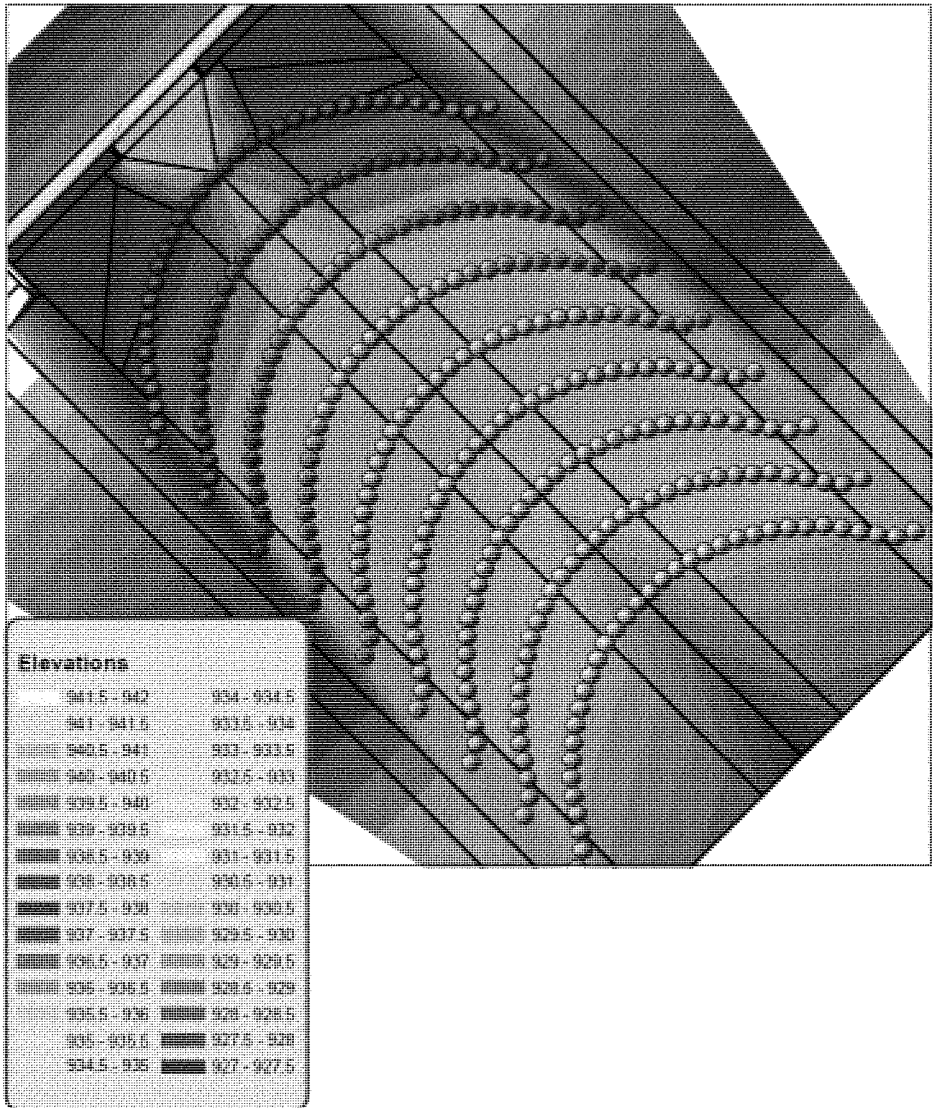
Marsh Lake Reservoir

Weighted Wind Fetch

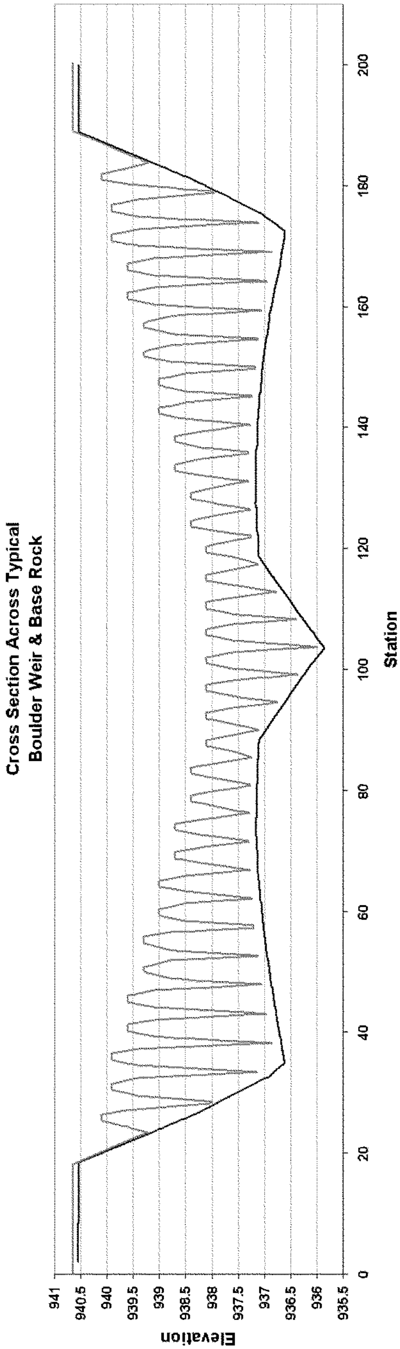



Marsh Lake Proposed Primary Spillway Modifications
Estimated Discharge Rating Curve for Various Tailwater Conditions
Modeling Parameters
•Geometry of actual boulders defined in XSs
•Roughness Defined as K = 1
•Contraction/Expansion Coeff: 0.1/0.3
Pool Elevation
950
948
946
944
942
940
938
936
Flow (CFS)
0
2000
4000
6000
8000
10000
12000
14000

Marsh Lake Dam
Proposed Modification to Primary Spillway

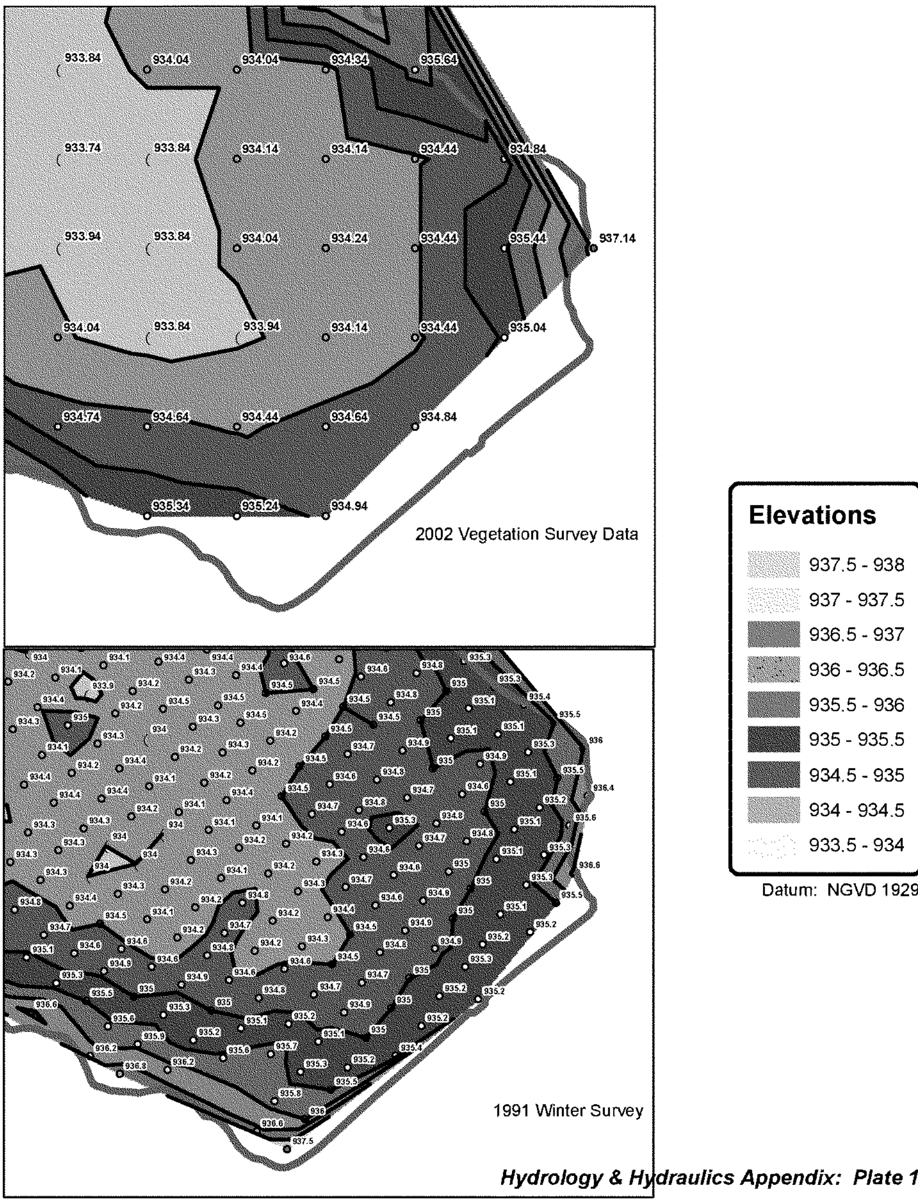


Hydrology & Hydraulics Appendix: Plate 15

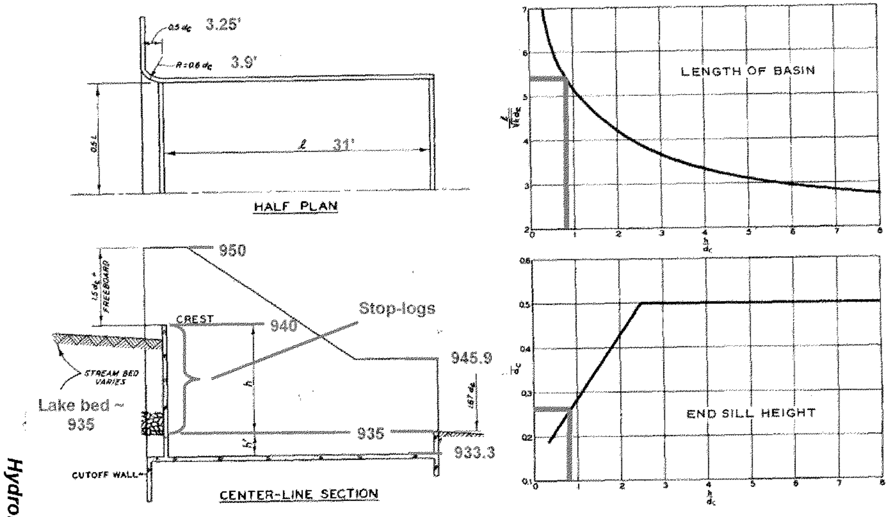

Cross Section Across Typical
Boulder Weir & Base Rock
Elevation
941
940.5
940
939.5
939
938.5
938
937.5
937
936.5
936
935.5
0
20
40
60
80
100
120
140
160
180
200
Station

Marsh Lake Bathymetry Near Outlet

Simple interpolation of raw survey points



Hydrology & Hydraulics Appendix: Plate 17



C = WEIR DISCHARGE = 3.0
d_c = CRITICAL DEPTH OVER CREST
h = HEIGHT OF DROP
h' = HEIGHT OF END SILL
H = HEAD ON WEIR = 3/2(d_c)

ℓ = LENGTH OF BASIN
L = LENGTH OF WEIR CREST
Q = DISCHARGE, $CLH^{3/2}$

DETAILS AND DESIGN CHART
FOR TYPICAL DROP STRUCTURE

Marsh Lake Drawdown Structure

Hydraulic Design Parameters

Design Pool	950'
Q (cfs)	8500
q (cfs/ft)	94
d_c (ft)	6.5
h (ft)	5
h/d_c	0.77

$$\frac{l}{\sqrt{hd_c}}=5.4$$

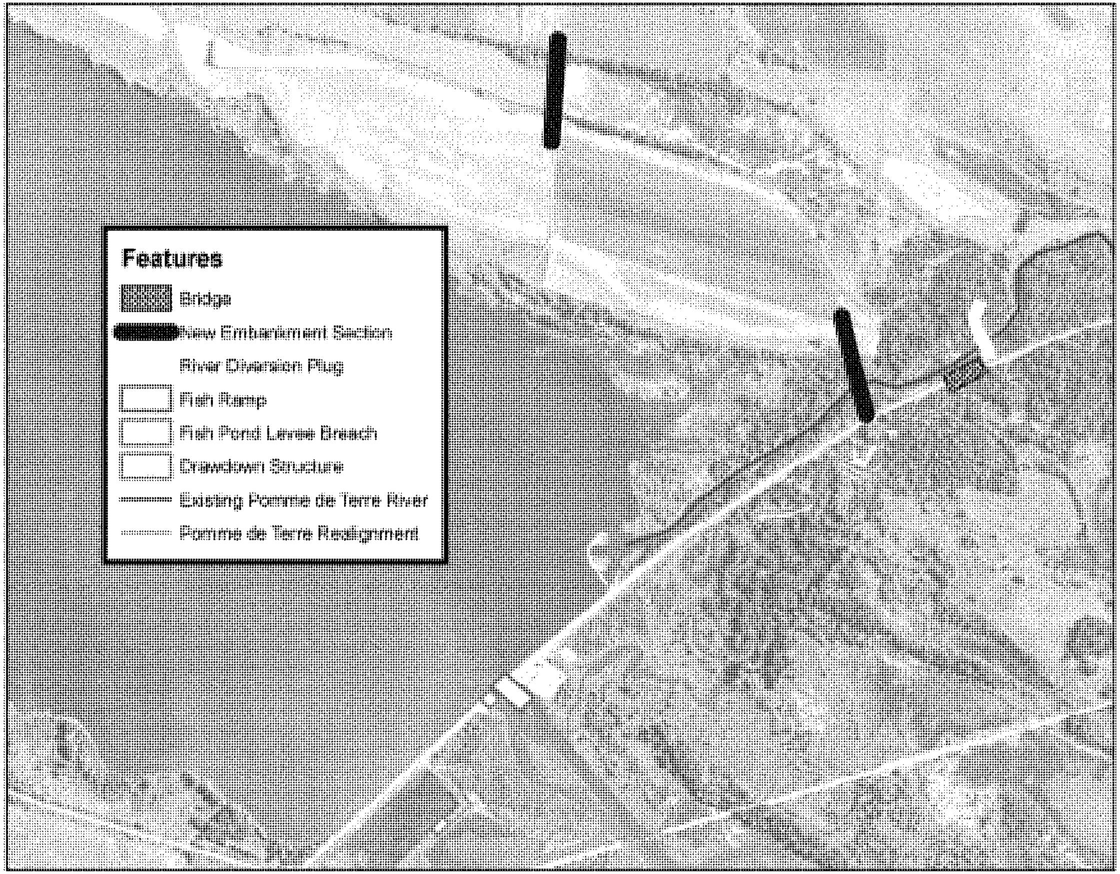
$$\frac{h'}{d_c}=0.25$$

Sizing & Dimensions

Length of Basin	31'
Elevation of Crest (top of stop logs)	940.0
Elevation of Crest (bottom of stop logs)	935.0
Elevation of Basin	933.3
Elevation of Top of End Sill	935.0
Elevation of Top of Wingwall (upstream)	950.0
Elevation of Top of Wingwall (downstream)	945.9
Abutment Radius	3.9'
Abutment upstream offset	3.25'

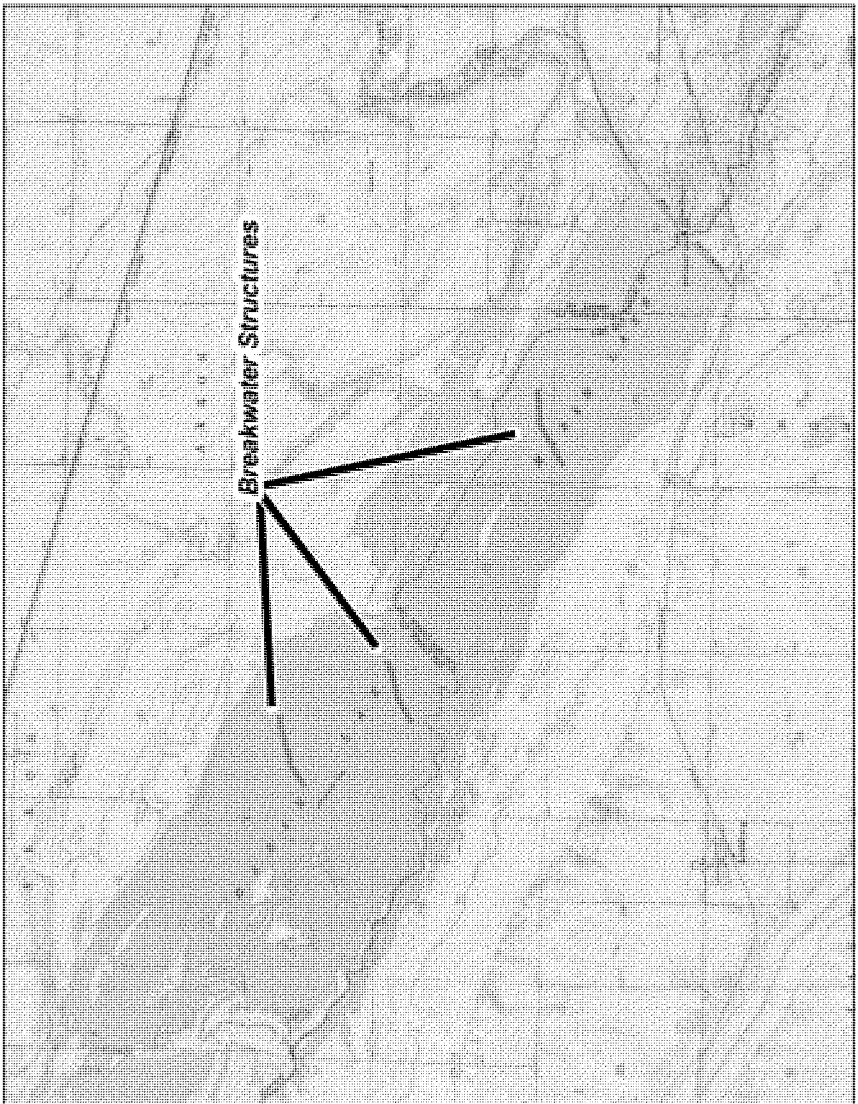
Marsh Lake Reservoir

Dam Modification / Pomme de Terre Realignment / Fish Pond Breach



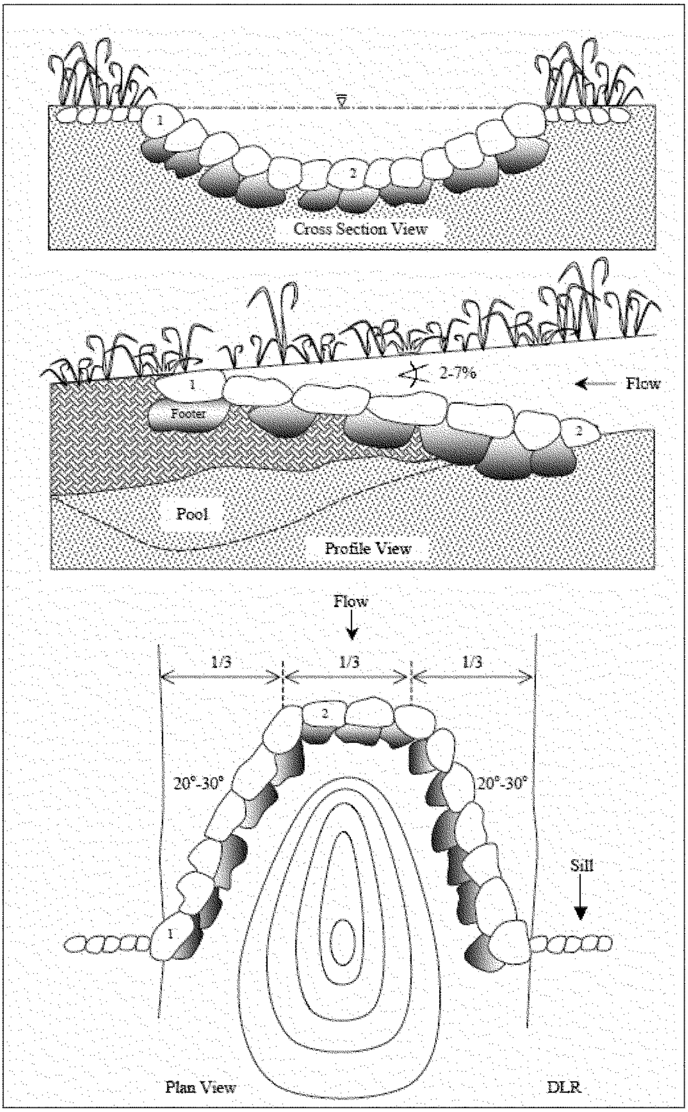
Marsh Lake Reservoir

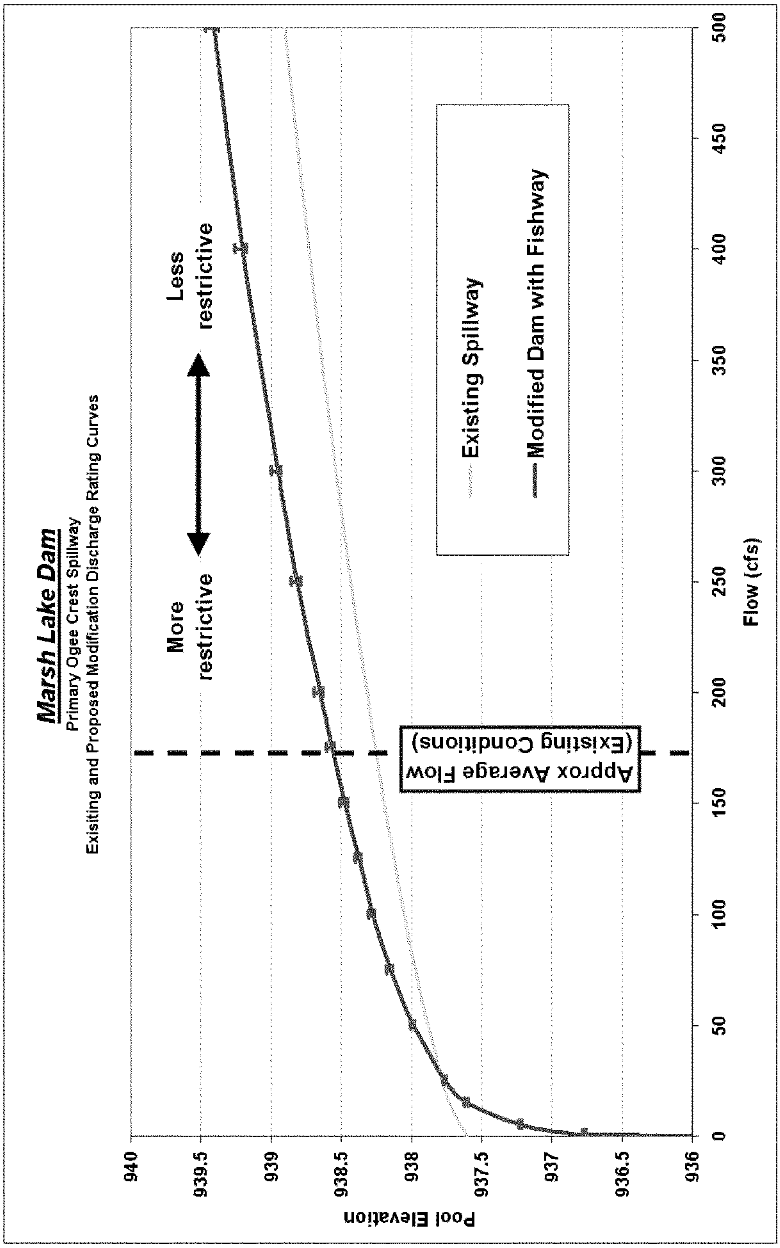
Proposed Breakwater Structure Layout



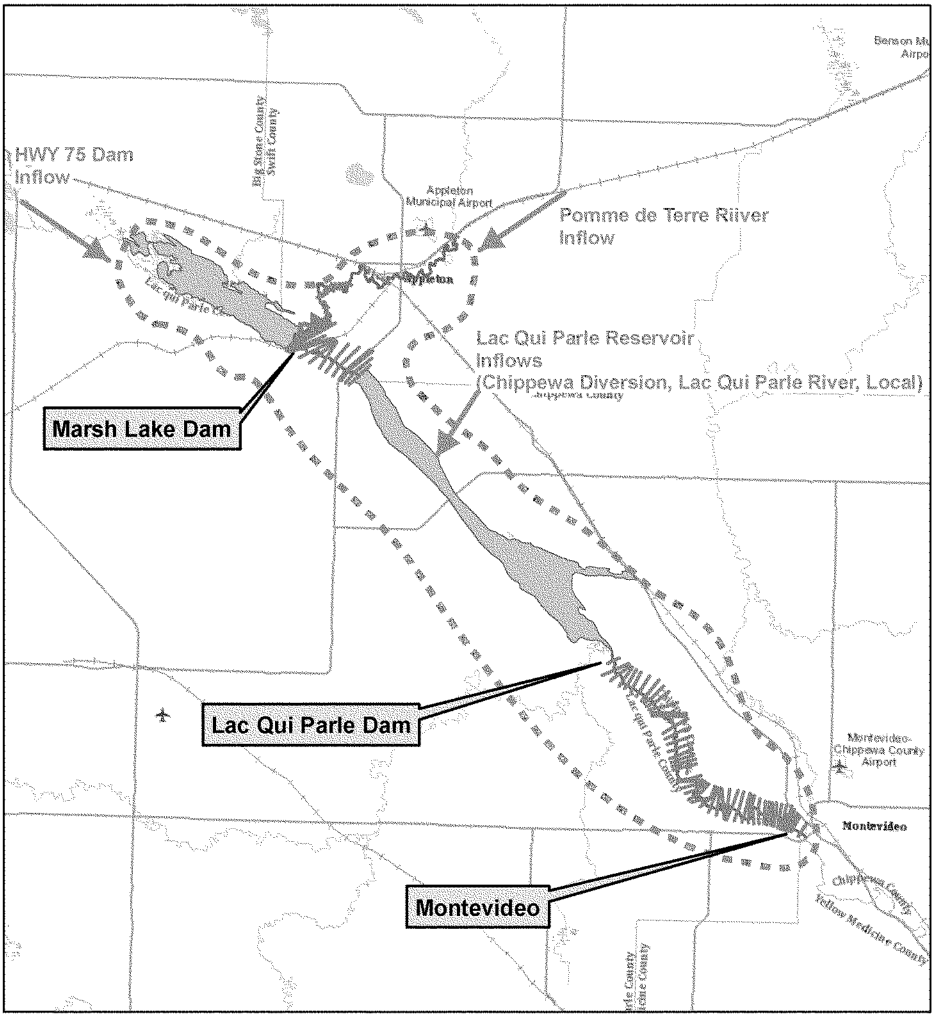
Conceptual Design of Re-routed Pomme de Terre Grade Control Structures

*per Reference 9: Wildland Hydrology/Dave Rosgen



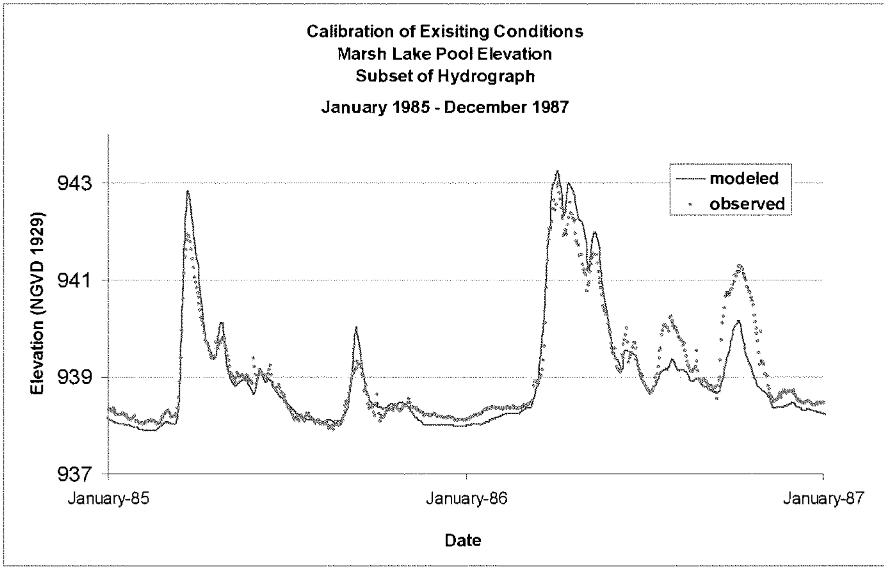

Marsh Lake Dam
Primary Ogee Crest Spillway
Exisiting and Proposed Modification Discharge Rating Curves
More restrictive
Less restrictive
Approx Average Flow (Existing Conditions)
Existing Spillway
Modified Dam with Fishway
Pool Elevation
940
939.5
939
938.5
938
937.5
937
936.5
936
Flow (cfs)
0
50
100
150
200
250
300
350
400
450
500

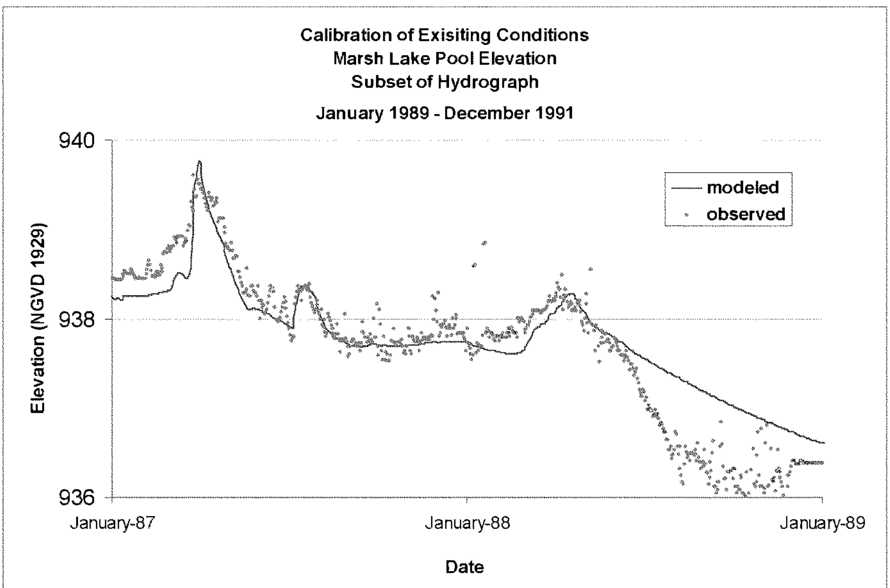
Marsh Lake
Unsteady HEC-RAS Model Schematic



Water Level Hydraulic Model Calibration and Validation

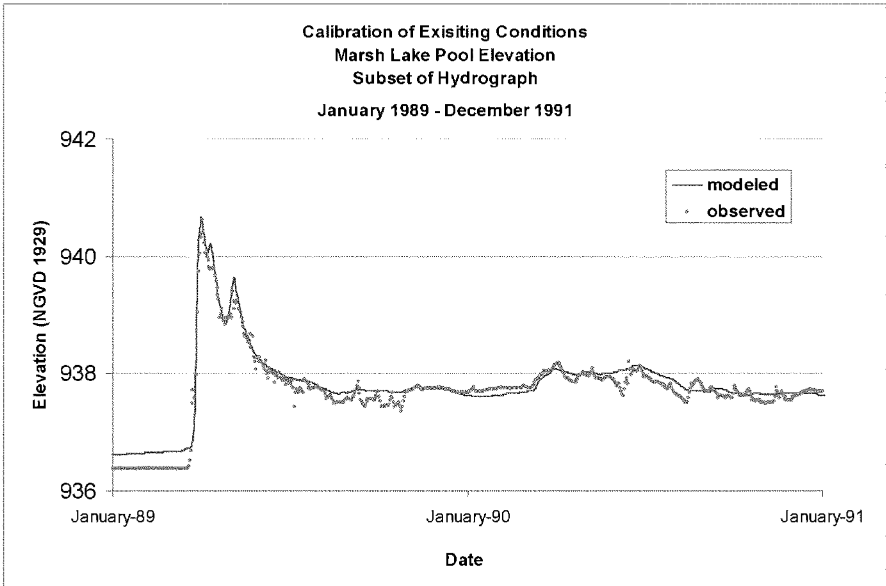
Marsh Lake Water Surface Elevation
Modeled and Observed Data

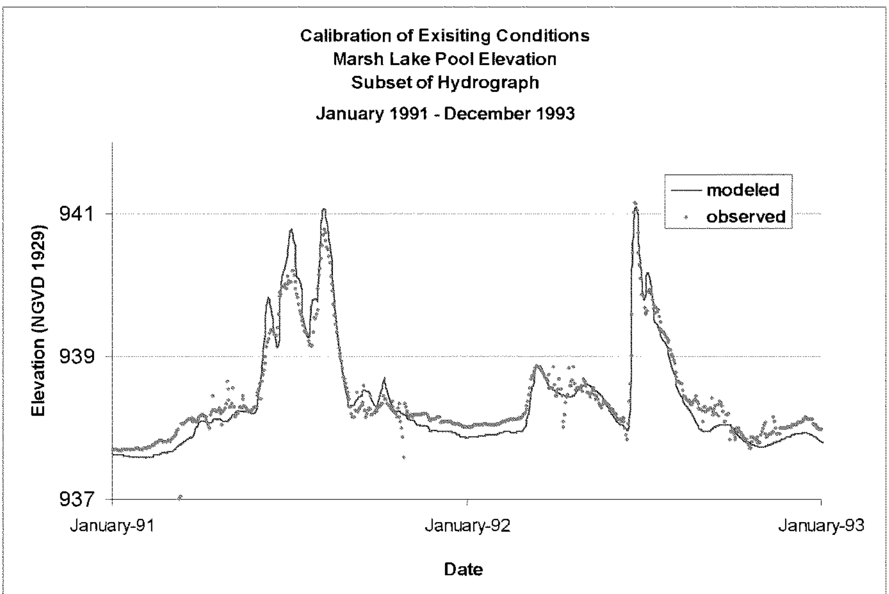




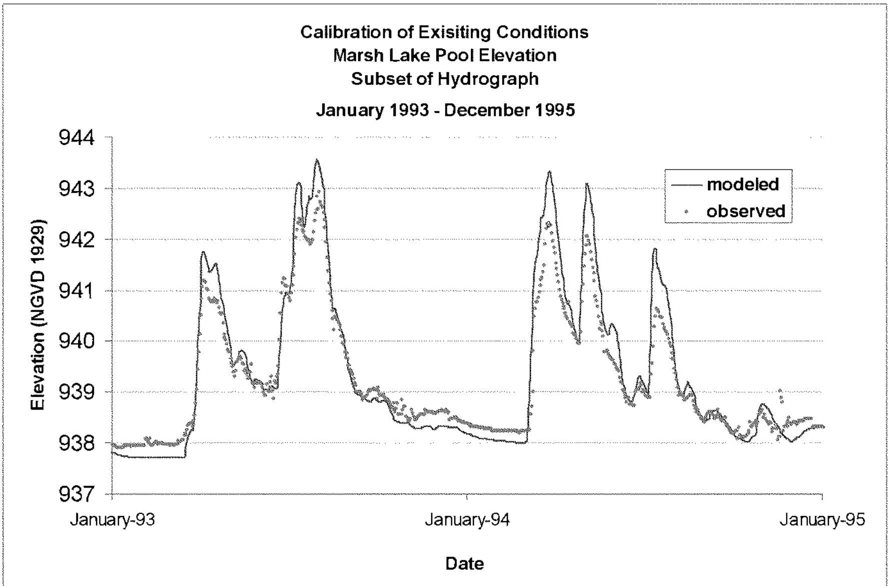
Water Level Hydraulic Model Calibration and Validation

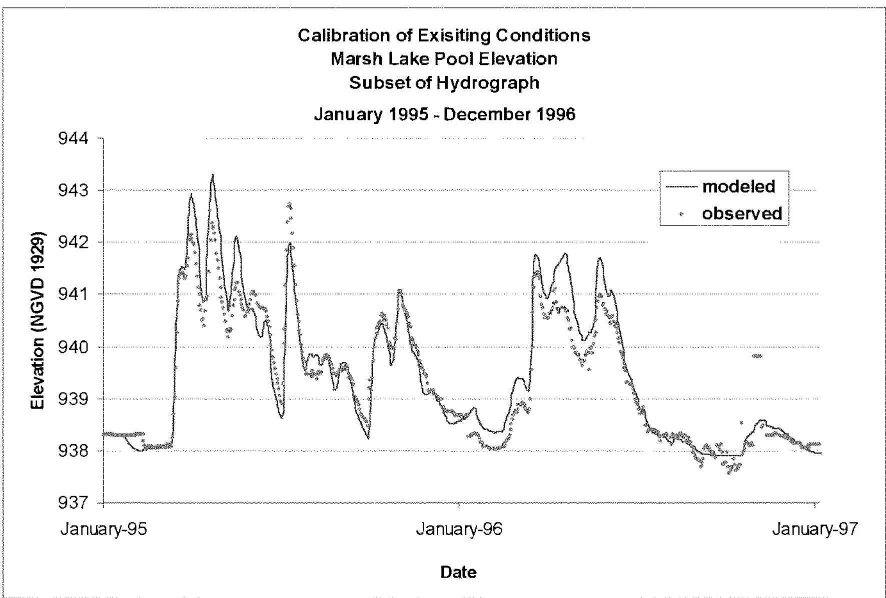
Marsh Lake Water Surface Elevation
Modeled and Observed Data



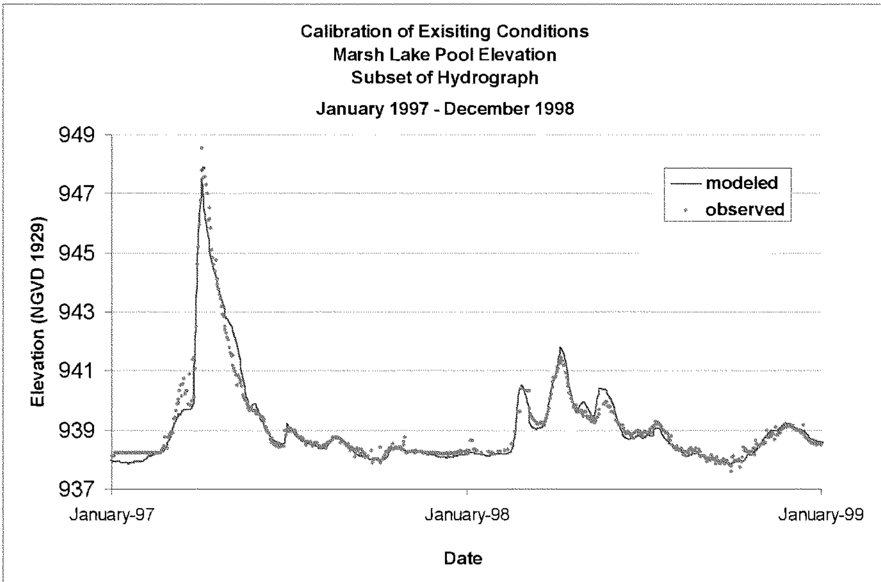


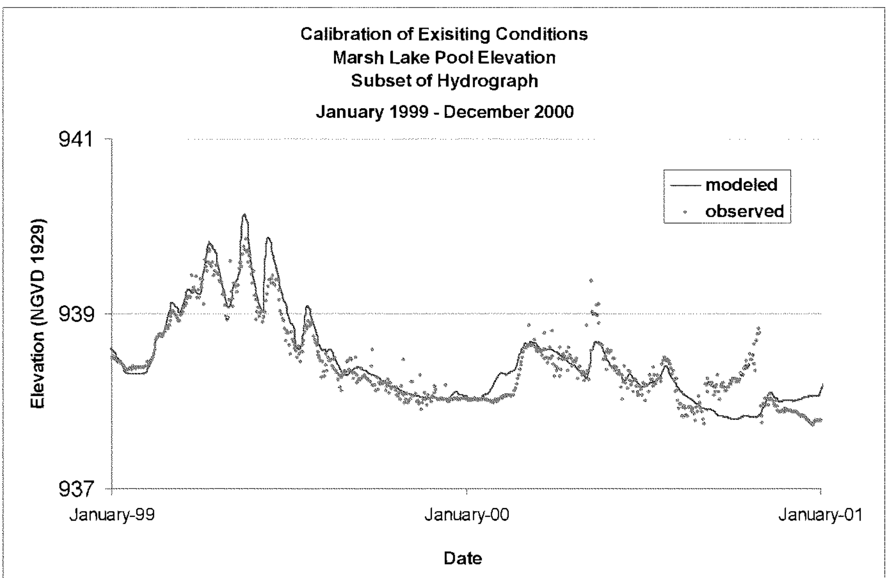
Water Level Hydraulic Model Calibration and Validation
Marsh Lake Water Surface Elevation
Modeled and Observed Data





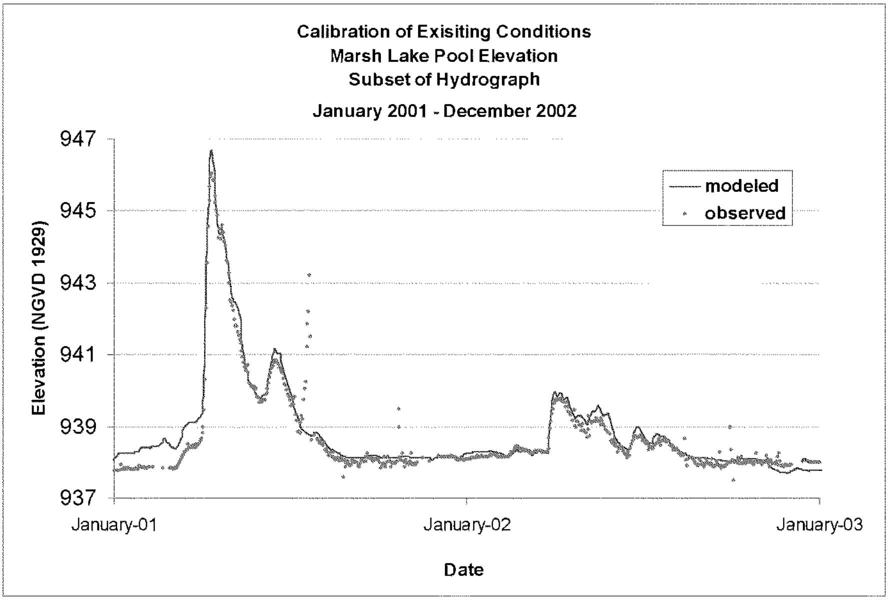
Water Level Hydraulic Model Calibration and Validation
Marsh Lake Water Surface Elevation
Modeled and Observed Data





Water Level Hydraulic Model Calibration and Validation

Marsh Lake Water Surface Elevation
Modeled and Observed Data



Appendix K – Structural Analysis

Marsh Lake Aquatic Ecosystem Restoration Project
Structural Feasibility Study

1 General

This study outlines five proposed structures for the Marsh Lake Aquatic Ecosystem Restoration Project. Concrete, excavation, sheet pile, and aluminum stoplog quantities are tabulated at the end of the report.

General Assumptions:

1. All concrete walls are assumed to be founded on 2' thick footings and extend 3' below grade. Bottom of footing elevation will be at 5' below grade.

2 Structural Features

2.1 Culverts beneath Louisburg Grade Road

Description:

Seven existing 60" diameter RCP culverts cross below Louisburg Grade Road connecting the upper and lower pools of Marsh Lake. As a result of Marsh Lake drawdown requirements, water level control will be required in 6" increments on all of these culverts, and therefore, headwalls with stop log tracks will be provided.

Assumptions:

1. Southern three existing RCP's replaced with a single 3 cell RCP box culvert (see Figure 1)
2. Northern four existing RCP's replaced with two 2 cell RCP box culvert (see Figure 1)

Questions and Uncertainties:

1. Is dewatering required?

2.2 Existing Spillway South East of Marsh Lake

Description:

The existing spillway requires removal of concrete to establish a new elevation of 935.5' down from 937.6' as shown in Figure 2.

Assumptions:

1. Removal of approximately 3' Deep x 10' Wide x 30' Length of existing concrete,
2. Dowel into existing concrete, and add 1' of new concrete (see quantities)

Questions and Uncertainties:

1. Is dewatering required?
2. Is there concrete repair required aside from the notch?

2.3 Drawdown Structure SW of Marsh Lake

Description:

A drawdown structure (see Figure 3) is required which would provide a top of water elevation between 935' and 940'.

Assumptions:

1. Stop logs will be used to achieve the elevation desired by the local sponsor
2. Soil conditions permit the use of a bearing foundation (no load bearing piles required)

3. Sheet piling extending six feet below the bottom of the footing at the head water to prevent seepage and scour
4. A concrete apron will be used down stream from the structure with sheet piling below to prevent erosion
5. Abutments will be assumed on either side of the drawdown structure to retain existing dam elevations on both sides
6. A 16' wide concrete walkway will be assumed to span the entire 116'-6" length of the drawdown structure

Questions and Uncertainties:

1. Will walkway surface at (bottom @ 948.6') cause a hydraulic concern during flood events?
2. Is dewatering required for construction?

2.4 Two Lane Bridge over Pomme Du Terre River

Description:

A vehicular bridge is required to cross the Pomme De Terre River. Two alternatives may be considered:

1. 5 span bridge with 46" deep precast concrete girders (plus an 8" deck)
2. 3 span bridge with 88" deep precast concrete girders (plus an 8" deck)

Assumptions:

1. 450' Long x 32' Wide, 2 vehicular lanes
2. The bridge will be supported on vertical concrete abutments
3. Unit cost of bridge: $150/sf

Questions and Uncertainties:

1. Deviations beyond assumptions may add to unit cost
2. Will additional concrete and/or riprap be required for hydraulic reasons?
3. Alternative 2 may require a raise in bridge deck height, and thus, sloped approaches

2.5 Pedestrian Bridge over Existing Spillway

Description:

A prefabricated pedestrian bridge crossing the existing spillway

Assumptions:

1. 120' Long, Poured Concrete Deck, Weathering Steel, Design per AASHTO
2. 6' Width ($64,000 per Continental Bridge, concrete deck not included)
3. 10' Width ($85,000 per Continental Bridge, concrete deck not included)

Questions and Uncertainties:

1. Will repair work be required on the existing spillway structure to adequately support pedestrian bridge?

Table 1: Concrete Quantities

Item		Quantity (yd^3)
2.1:	Culverts:	**322**
2.2:	Existing Spillway:	**10**
2.3a:	Drawdown (footing):	**685**
2.3b:	Drawdown (walls):	**333**
2.3c:	Drawdown (slab):	**70**
2.4:	2 Lane Bridge:	**90**
2.5:	Pedestrian Bridge:	*NA*
	Total:	**1,510**

Table 2: Excavation Quantities

Item		Quantity (yd^3)
2.1:	Culverts:	**2,162**
2.2:	Existing Spillway:	*NA*
2.3:	Drawdown Structure:	**1,947**
2.4:	2 Lane Bridge:	*NA*
2.5:	Pedestrian Bridge:	*NA*
	Total:	**4,109**

Table 3: Sheetpiling

Item		Area (ft^2)
2.1:	Culverts:	*NA*
2.2:	Existing Spillway:	*NA*
2.3:	Drawdown Structure:	**1,260**
2.4:	2 Lane Bridge:	*NA*
2.5:	Pedestrian Bridge:	*NA*
	Total:	**1,260**

Table 4: Aluminum Stop Logs

Item		Weight (lb)
2.1:	Culverts:	**1,676**
2.2:	Existing Spillway:	*NA*
2.3:	Drawdown Structure:	**6,267**
2.4:	2 Lane Bridge:	*NA*
2.5:	Pedestrian Bridge:	*NA*

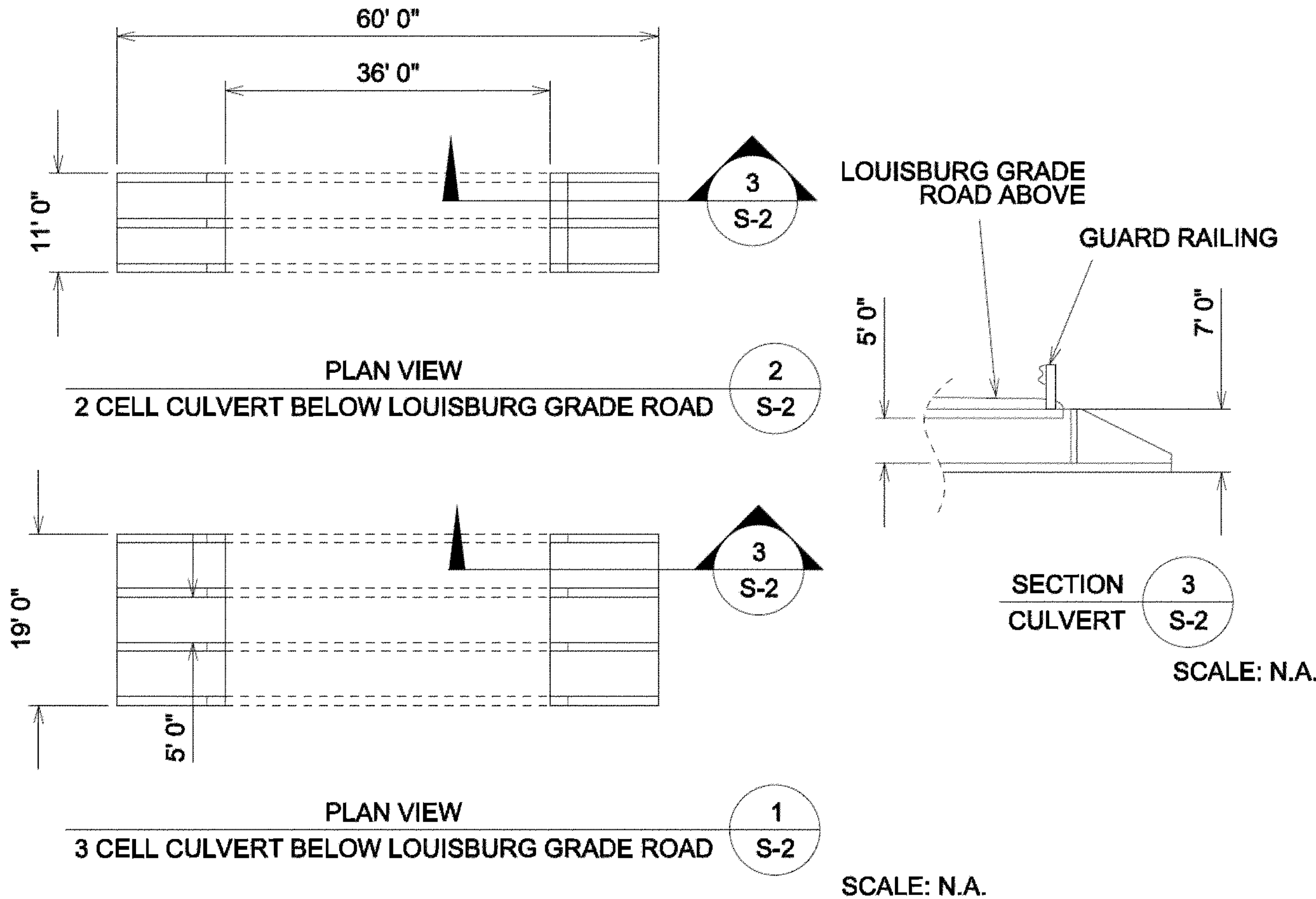


Figure 1: Culverts below Louisburg Grade Road

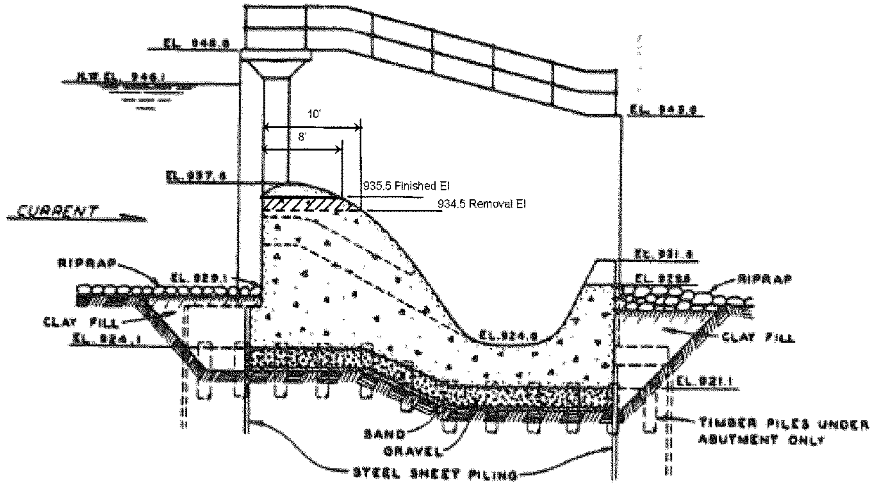


Figure 2: Concrete removal on existing spillway

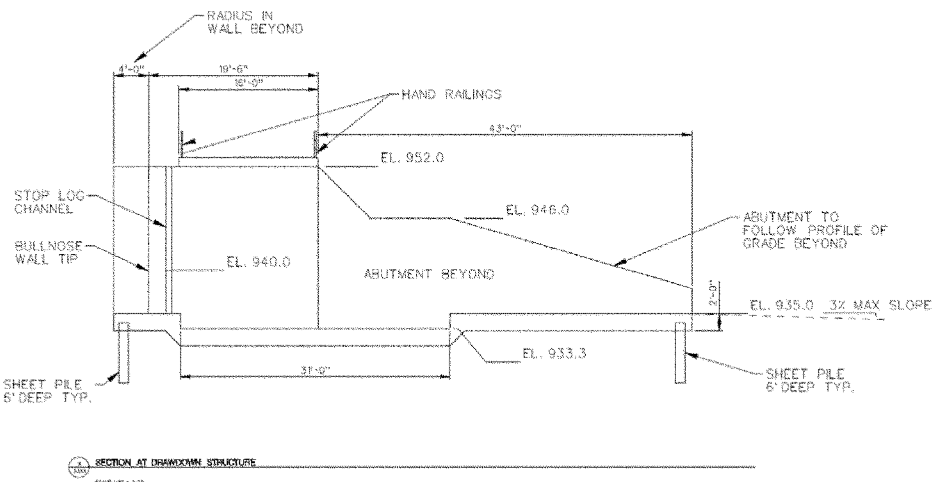


Figure 3: Drawdown Section Cut

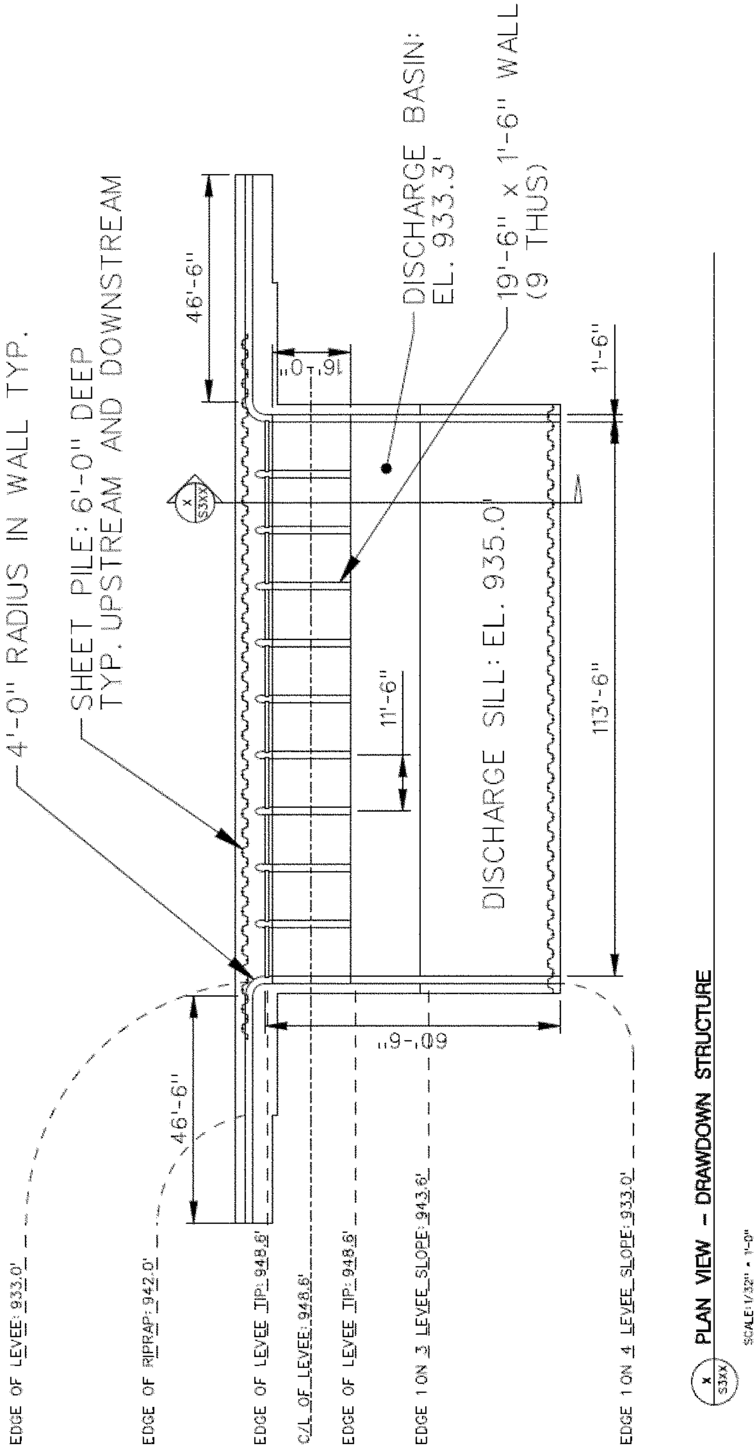


Figure 4: Drawdown Structure Plan View

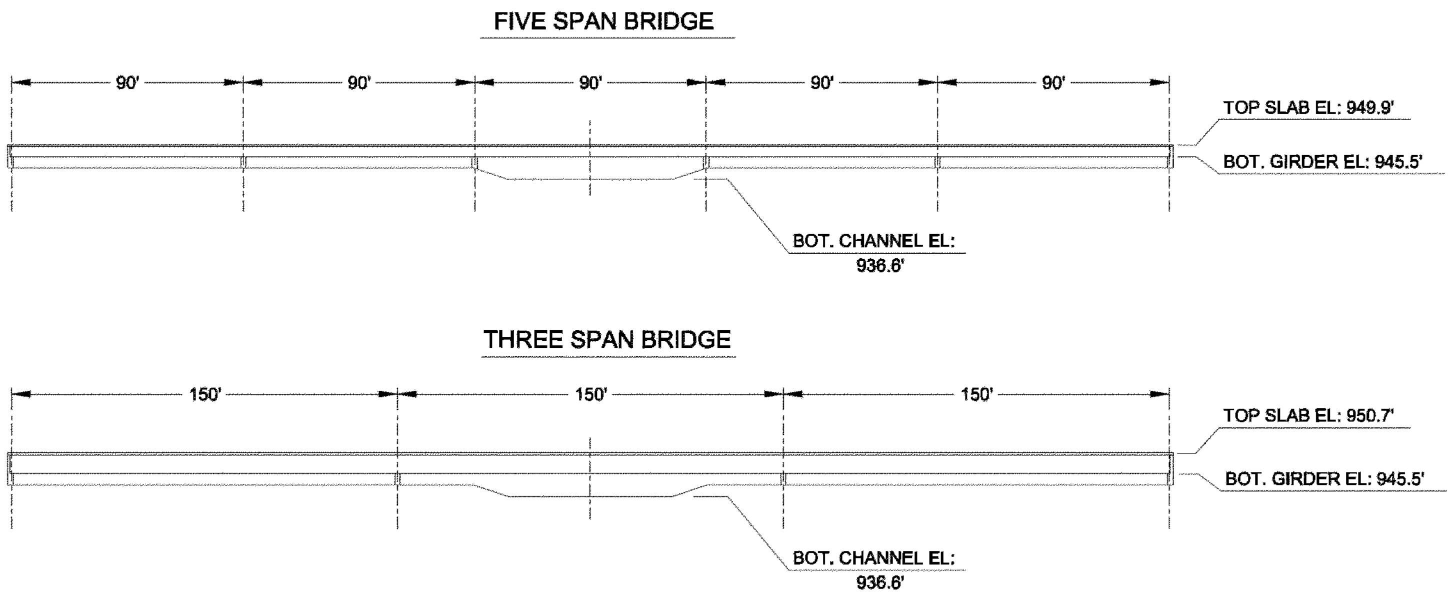


Figure 4: Bridge over Pomme De Terre River (2 alternatives)

Appendix L – Distribution List

Marsh Lake Mailing List

NEPA Coordination
May 2011

Federal

Mr. Kenneth Westlake (Separate Letter)
NEPA Implementation Section
USEPA REGION 5
77 West Jackson Boulevard
Mail Code: E-19J
Chicago, IL 60604-3507

Mr. Tony Sullins (Separate Letter)
Field Supervisor
Fish and Wildlife Service
Twin Cities Field Office
4101 East 80th Street
Bloomington, MN 55425-1665

cf: Alice Hanley, Manager
U.S. Fish and Wildlife Service
Big Stone National Wildlife Refuge
44843 County Road 19
Odessa, MN 56276

Tribes

Gabe Prescott
President
Tribal Council
Lower Sioux Indian Community
39527 Res. Highway 1
P.O. Box 308
Morton, MN 56270

Deb Dirlam
Office of the Environment Director
Lower Sioux Indian Community
P.O. Box 308
39527 Res Hwy 1
Morton, MN 56270

Robert Shepherd
Tribal Chairman
Sisseton-Wahpeton Oyate
P.O. Box 509
Agency Village, SD 57262

State

Mr. Steve Colvin (Separate Letter)
Environmental Review Section
Minnesota Department of Natural Resources
500 Lafayette Road-Box 10
St. Paul, Minnesota 55155-4010

Mr. Craig Affeldt (Separate Letter)
Municipal Division
Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, MN 55155

Ms Mary Ann Heidemann
Government Programs and Compliance Officer
State Historic Preservation Office
Minnesota Historical Society
345 Kellogg Boulevard West
St. Paul, MN 55102-1906

Local

Dawn Hegeland
Upper Minnesota Valley RDC
323 West Schlieman Ave.
Appleton, MN 56208

Big Stone County Board
20 SE 2nd Street
Ortonville, MN 56278

Lac qui Parle County Board
600 – 6th Street
Madison, MN 56256

Swift County Board
301 North 14th Street
Benson, MN 56215

Chippewa County Board
629 North 11th Street
Montevideo, MN 56265

Montevideo VCB/Chamber of Commerce
202 North 1st Street
Montevideo, MN 56265

Madison VCB/Chamber of Commerce
404 – 6th Avenue
Madison, MN 56256

Ortonville VCB/Chamber of Commerce
987 U.S. Highway 12
Ortonville, MN 56278

Western MN Prairie Waters
323 West Schlieman Ave.
Appleton, MN 56208

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Prairie Country RC&D
1005 High Street NE
Willmar, MN 56201-2667

City of Granite Falls
885 Prentice Street
Granite Falls, MN 56241

City of Montevideo
629 North 11th Street
Montevideo, MN 56265

City of Milan
P.O. Box 162
Milan, MN 56262

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Commissioner Tom Landwehr
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Commissioner
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Natural Resources Dept
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Appleton, MN 56208

Win Mitchell
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Northfield, MN 55057

Dan Enke
324 South Hering
Appleton, MN 56208

Dr. William E. Faber
Central Lakes College – Dept. of Natural Resources
501 West College Drive
Brainerd, MN 56401

Scott Munson
LQP Lake Association
PO Box 66
Montevideo, MN 56265

NGOs

Appleton Sportsmen's Club
PO Box 75
Appleton, MN 56208

Bruce Dehne
Holloway Sportsmen's Club
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Holloway, MN 56249

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(MN & IA)
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Ducks Unlimited
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Spicer, MN 56288

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St. Paul, MN 55103

Appendix M – Real Estate Plan

PRELIMINARY REAL ESTATE PLAN
MARSH LAKE ECOSYSTEM RESTORATION PROJECT

22 November, 2010

1. General Description: This Real Estate Plan is part of the draft Feasibility Report for the Marsh Lake Ecosystem Restoration Project. Marsh Lake is a shallow 5,000 acre reservoir with an average depth of approximately 3 feet. Marsh Lake is located in Big Stone County, approximately 4 miles west of Appleton, Minnesota. The Marsh Lake Dam has a fixed crest elevation and was built as a Works Progress Administration project sponsored by the State of Minnesota and was completed in 1938. The dam increased lake-like fish and wildlife habitat and created new colonial water bird habitat, but it also disrupted natural flood plain functions and blocked fish movement. The lack of natural flooding and drying cycles combined with increased sedimentation in the reservoir have caused a decline in plant diversity, water quality and associated fish and wildlife benefits over the years since the dam was built.

2. PROJECT AUTHORIZATION: Authorization was recommended in the December 2004 Minnesota River Reconnaissance study (approved January 13, 2005) and is authorized by a May 10, 1962 resolution of the House Committee on Public Works. Federal (Corps of Engineers) interest in Marsh Lake is based on the potential benefits of aquatic ecosystem restoration and the fact that the existing Marsh Lake Dam is owned and operated by the Corps of Engineers.

3. PROJECT DESCRIPTION: To restore aquatic and riparian habitat in Marsh Lake and restore connectivity between Lac qui Parle and the Pomme de Terre River. The major features include modifying the Marsh Lake Dam to allow for periodic drawdown, fish passage and more natural variation in water surface; returning the Pomme de Terre River to its pre-dam alignment; installation of rock island structures to reduce sediment resuspension within the lake; and developing a management plan to define how the new features would be used.

4. NON-FEDERAL SPONSOR-OWNED LER: The Minnesota Department of Natural Resources (DNR) is sponsoring the study. The DNR also has fee title to the entire lake area northwest of the dam and southeast of Corps fee title land in and around the dam. The State of Minnesota received LERRDs credits at the initial construction of the dam and surrounding area in 1938. DNR has agreed there will be no new lands for LERRDs crediting provided for this project.

5. ESTATES: The Minnesota Department of Natural Resources and U.S. Army Corps of Engineers own all necessary land in fee title required for the project.

6. EXISTING FEDERAL PROJECT: The lands required for this project are within the La Qui Parle Reservoir on the Minnesota River, Watson, Minnesota.

7. FEDERALLY-OWNED LANDS: All necessary LER required for this project are federal or state-owned lands.

8. NAVIGATIONAL SERVITUDE: The proposed work is not within the navigational servitude.

9. MAPS: Maps for reference are in the Appendix N, Plates.

10. INDUCED FLOODING: There will be no induced flooding as a result of the project

11. BASELINE COST ESTIMATE: The preliminary estimated value of the lands and damages for the project (including contingencies) are summarized below:

	Federal	Non-Federal	Total
Lands/damages	$0	$0	$ 0
RE Admin Costs	$10,000	$0	$ 10,000
Contingencies	$0	$0	$ 0
Total	$10,000	$0	$ 10,000
		Rounded	$ 10,000

The project is restoration in nature for lands that were previously provided with LERRDs credits in 1938. The only additional lands that may be necessary are from a potential 5.7 barrow site which will be restored to present condition at the completion of the project. The lands in and around this project are all low lying swamp ground with a value of $500.00 per acre. The difference in amount of land needed for the differing alternatives is insignificant for valuation purposes since each alternative is relatively the same amount of land.

Real Estate administrative costs include: realty specialist time, supervisory time, file openings, document review, document preparation to include the REP, data input, correspondence, meeting attendance and filing.

12. PUBLIC LAW 91-646 RESIDENCE/BUSINESS RELOCATIONS: No residential or business relocations are anticipated.

13. MINERAL ACTIVITY: No present or anticipated mineral activity is within the proposed project.

14. SPONSOR ASSESSMENT: An assessment was completed on the Sponsor. The Minnesota Department of Natural Resources has legal authority to acquire and hold title to real property for project purposes and has the power of eminent domain for this project.

15. ZONING: No application or enactment of zoning ordinances will be used for the proposed project.

16. ACQUISITION SCHEDULE: All lands necessary for this project are owned by either the Minnesota Department of Natural Resources or the U.S. Army Corps of Engineers.

17. FACILITY/UTILITY RELOCATIONS: No facility/utility relocations are required as part of the project.

18. ENVIRONMENTAL CLEARANCE: An environmental assessment will be prepared concurrently with the Feasibility Report. The Phase 1 HTRW report will be completed early in the design phase.

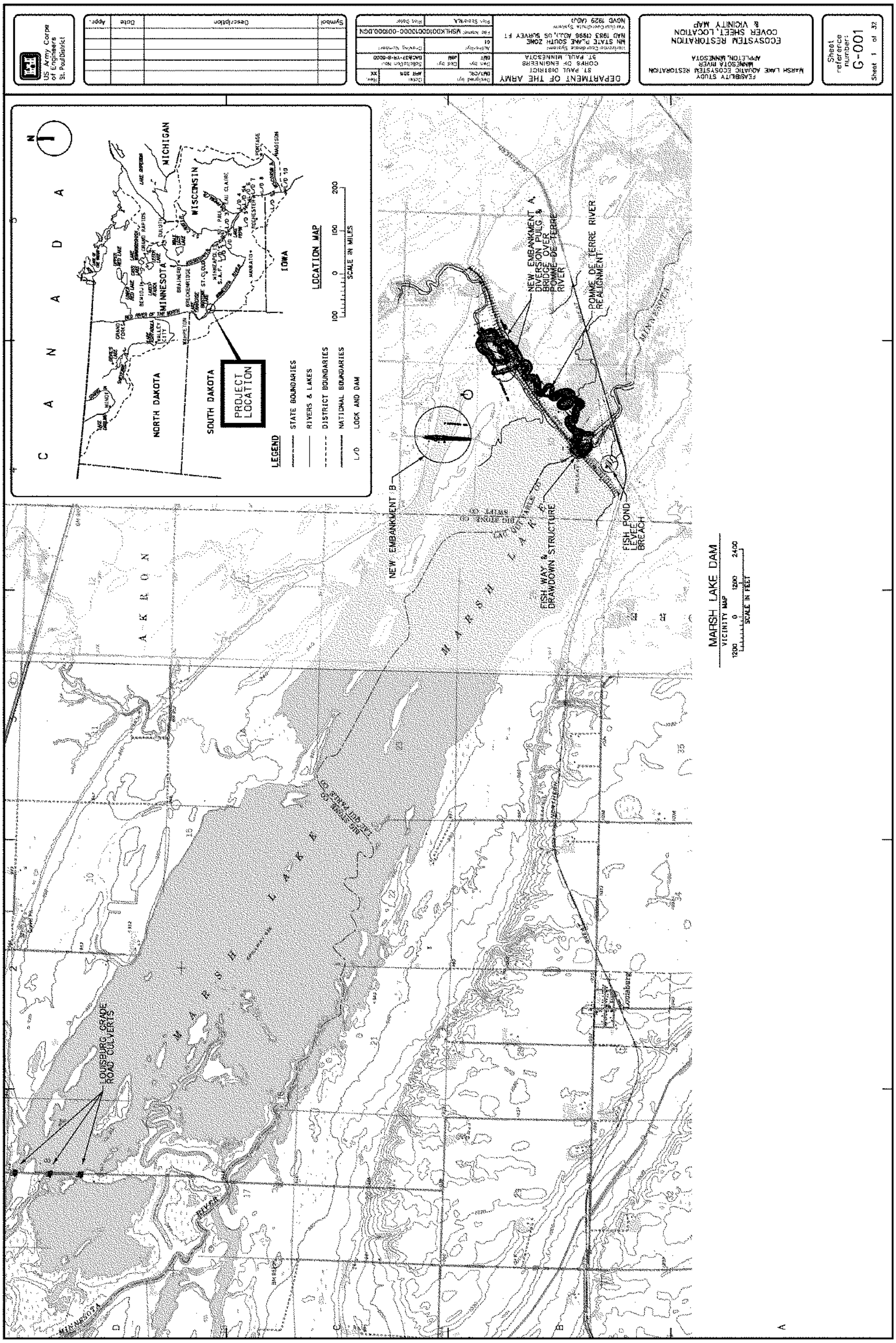
19. LANDOWNERS: The U.S. Army Corps of Engineers and the Minnesota Department of Natural Resources are both in favor of this project.

20. NON-FEDERAL SPONSOR NOTIFICATION: The Non-Federal Sponsor has been notified of the risk of acquiring LER prior to the execution of a Project Cooperation Agreement with the U.S. Army Corps of Engineers.

22 NOV, 2010

Rodney Peterson
Realty Specialist
St. Paul District, COE

Appendix N - Plates


US Army Corps of Engineers St. Paul District
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA
FEASIBILITY STUDY
MARSH LAKE AQUATIC ECOSYSTEM RESTORATION
MINNESOTA RIVER
APPLETON, MINNESOTA
ECOSYSTEM RESTORATION
COVER SHEET, LOCATION
& VICINITY MAP
Sheet reference number: G-001
Sheet 1 of 32
C A N A D A
NORTH DAKOTA
SOUTH DAKOTA
MINNESOTA
WISCONSIN
MICHIGAN
IOWA
PROJECT LOCATION
LEGEND
STATE BOUNDARIES
RIVERS & LAKES
DISTRICT BOUNDARIES
NATIONAL BOUNDARIES
LOCK AND DAM
LOCATION MAP
SCALE IN MILES
NEW EMBANKMENT A, DIVERSION PULG & BRIDGE OVER POMME-DE-TERRE RIVER
POMME DE TERRE RIVER REALIGNMENT
NEW EMBANKMENT B
FISH WAY & DRAWDOWN STRUCTURE
FISH POND LEVEE BREACH
MARSH LAKE
LOUISBURG GRADE ROAD CULVERTS
MARSH LAKE DAM
VICINITY MAP
SCALE IN FEET

FEASIBILITY STUDY DRAWING INDEX

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		INDEX DRAWINGS (CONTRACT AND REFERENCE DRAWINGS)	
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		CIVIL/SITE DRAWINGS	
DWG. NO. 3	C-001	GENERAL PLAN	MSHLKD05C001000C-103000.PDF
DWG. NO. 4	C-002	PLAN & PROF - FISH POND LEVEE BREACH, STA 0+75 TO 1+77	MSHLKD05C002000C-104000.PDF
DWG. NO. 5	C-003	PLAN - CHANNEL, STA 0+00 TO 10+60, FISHWAY, DRAWDOWN STRUC	MSHLKD05C003000C-105000.PDF
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DWG. NO. 7	C-005	PLAN - CHANNEL, STA 40+00 TO 61+60	MSHLKD05C005000C-107000.PDF
DWG. NO. 8	C-006	PLAN - CHANNEL, STA 61+60 TO 77+00	MSHLKD05C006000C-108000.PDF
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DWG. NO. 10	C-008	PLAN - CHANNEL, 94+00 TO C 113+90, DIVERSION PLUG 0+00 TO 5+39	MSHLKD05C006200C-108002.PDF
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DWG. NO. 13	C-011	NOT USED	
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DWG. NO. 15	C-013	NOT USED	
DWG. NO. 16	C-014	NOT USED	
DWG. NO. 17	C-015	NOT USED	
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DWG. NO. 19	C-017	PLAN - LOUISBURG ROAD CULVERT B	MSHLKD05C007100C-108011.PDF
DWG. NO. 20	C-018	PLAN - LOUISBURG ROAD CULVERT C	MSHLKD05C007200C-108012.PDF
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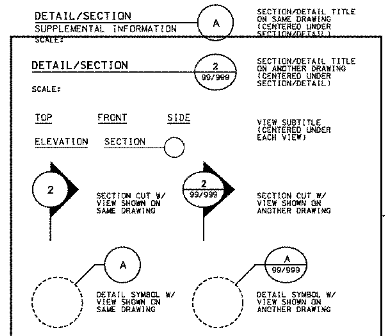
GENERAL CROSS-REFERENCING SYMBOLS



ABBREVIATIONS

* UNLESS OTHERWISE NOTED ON EACH SHEET

APPROX	APPROXIMATE	HT	HEIGHT
ALT W/	ALTERNATE WITH	IF	INSIDE FACE
ALUM	ALUMINUM	LG	LONG
BITUM	BITUMINOUS	L/W	LANDWARD
BOT	BOTTOM	MAX	MAXIMUM
C/L	CENTER LINE	MIN	MINIMUM
C&G	CURB & GUTTER	MIRR	MIRRORED
CLR	CLEAR	MISC	MISCELLANEOUS
CJ	CONSTRUCTION JOINT	NF	NEAR FACE
CMP	CORRUGATED METAL PIPE	NO	NUMBER
CONC	CONCRETE	OF	OUTSIDE FACE
		OC	ON CENTER
DIA	DIAMETER	R/W	RIVERWARD
DWG	DRAWING	SAN	SANITARY
EF	EACH FACE	SPEC	SPECIFICATIONS
EJ	EXPANSION JOINT	SST	STAINLESS STEEL
EL	ELEVATION	T&B	TOP AND BOTTOM
EW	EACH WAY	TYP	TYPICAL
EXIST	EXISTING	UNO	UNLESS NOTED OTHERWISE
FF	FAR FACE	UGND	UNDERGROUND
FES	FLARED END SECTION	W	WIDTH
GALV	GALVANIZED	WM	WATER MAIN

US Army Corps of Engineers
St. Paul District

Symbol	Description	Date	Appr.

Designed by: BMT/SMG		Date: APR 2011	Rev. XX
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Authority: GI		Drawing Number:	
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Plot Scale: NA		Plot Date:	

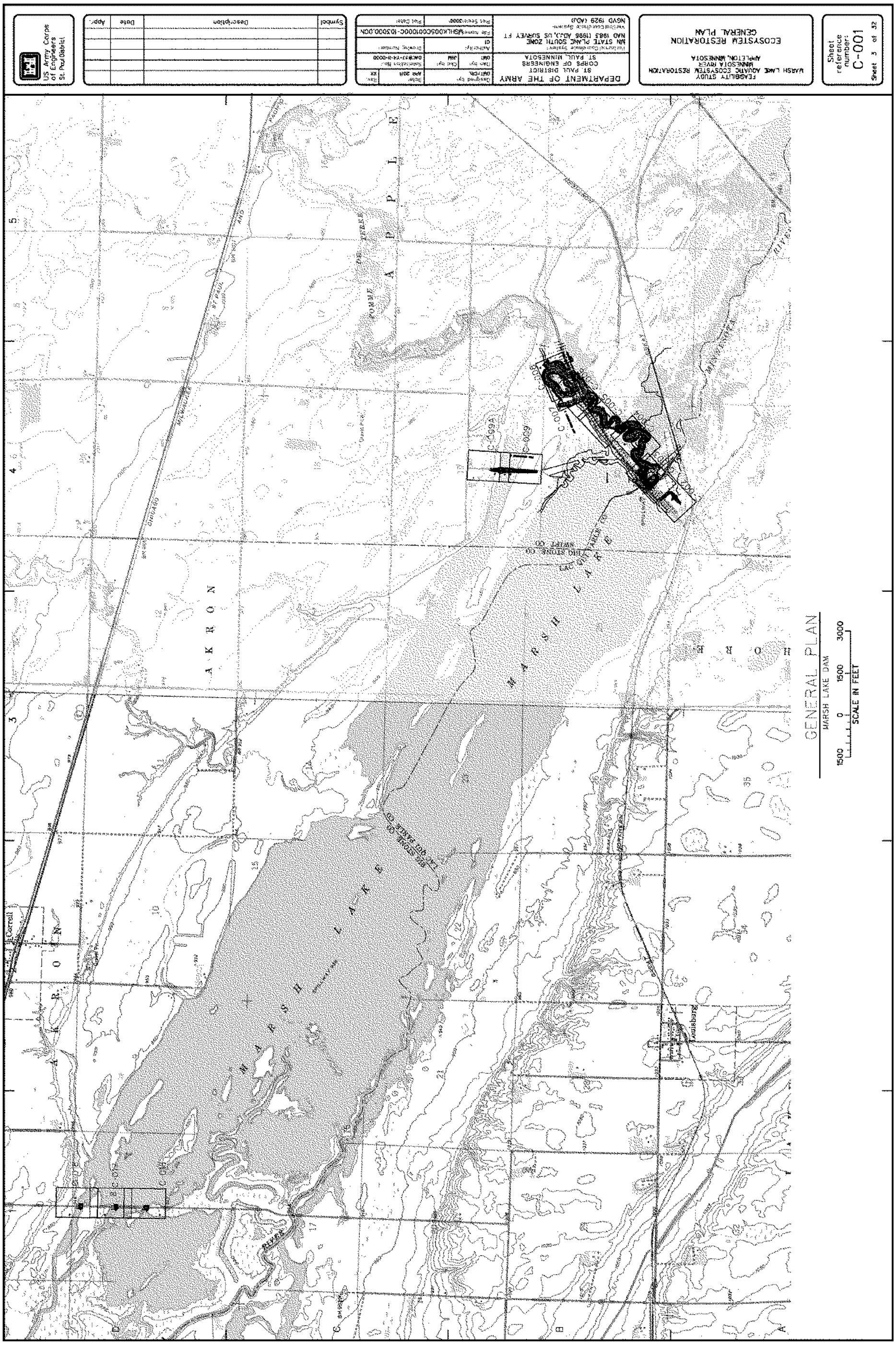
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

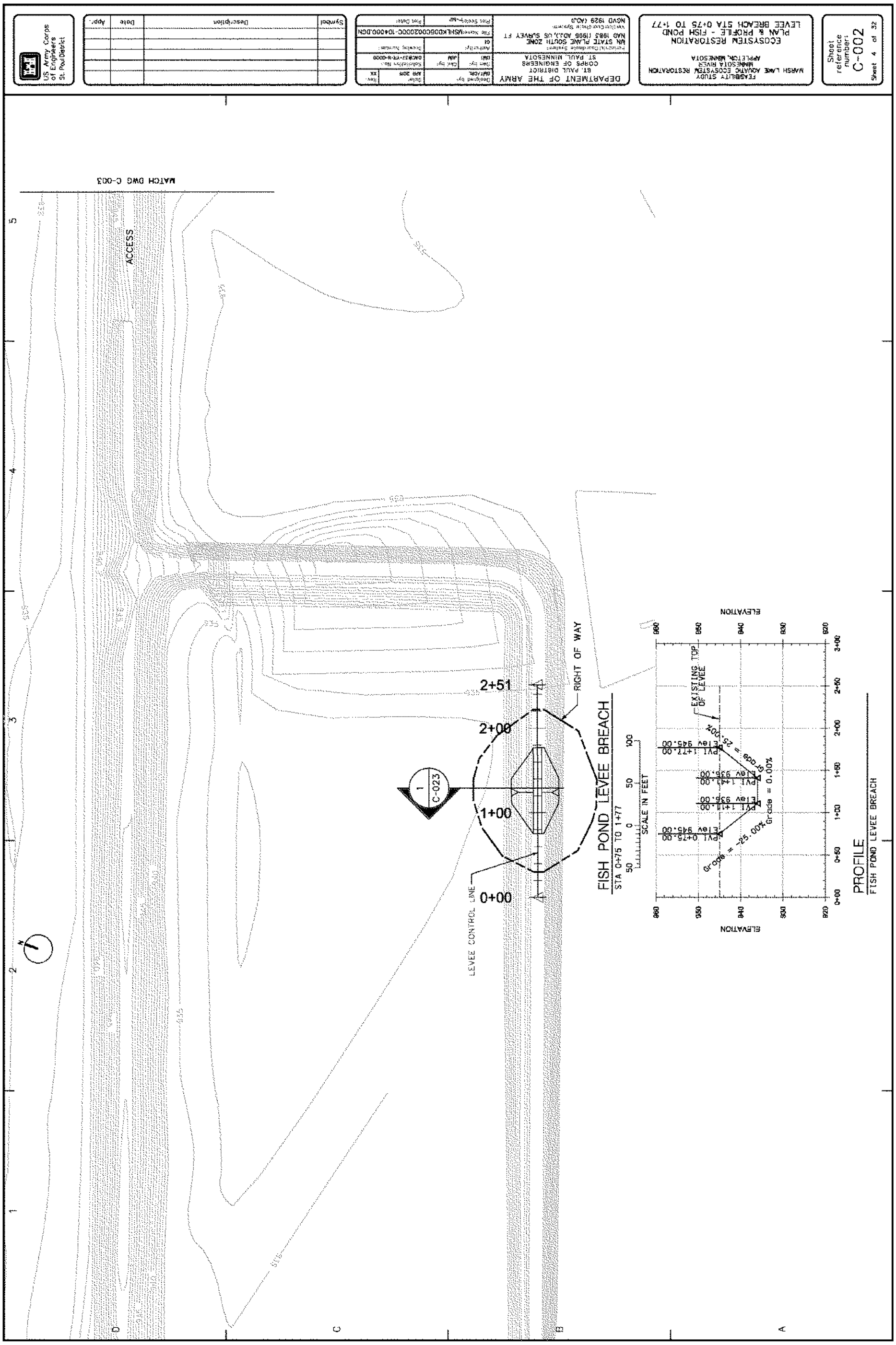
Horizontal Coordinate System:
MN STATE PLANE SOUTH ZONE
NAD 1983 (1996 ADJ), US SURVEY FT
Vertical Coordinate System:
NGVD 1929 (ADJ)

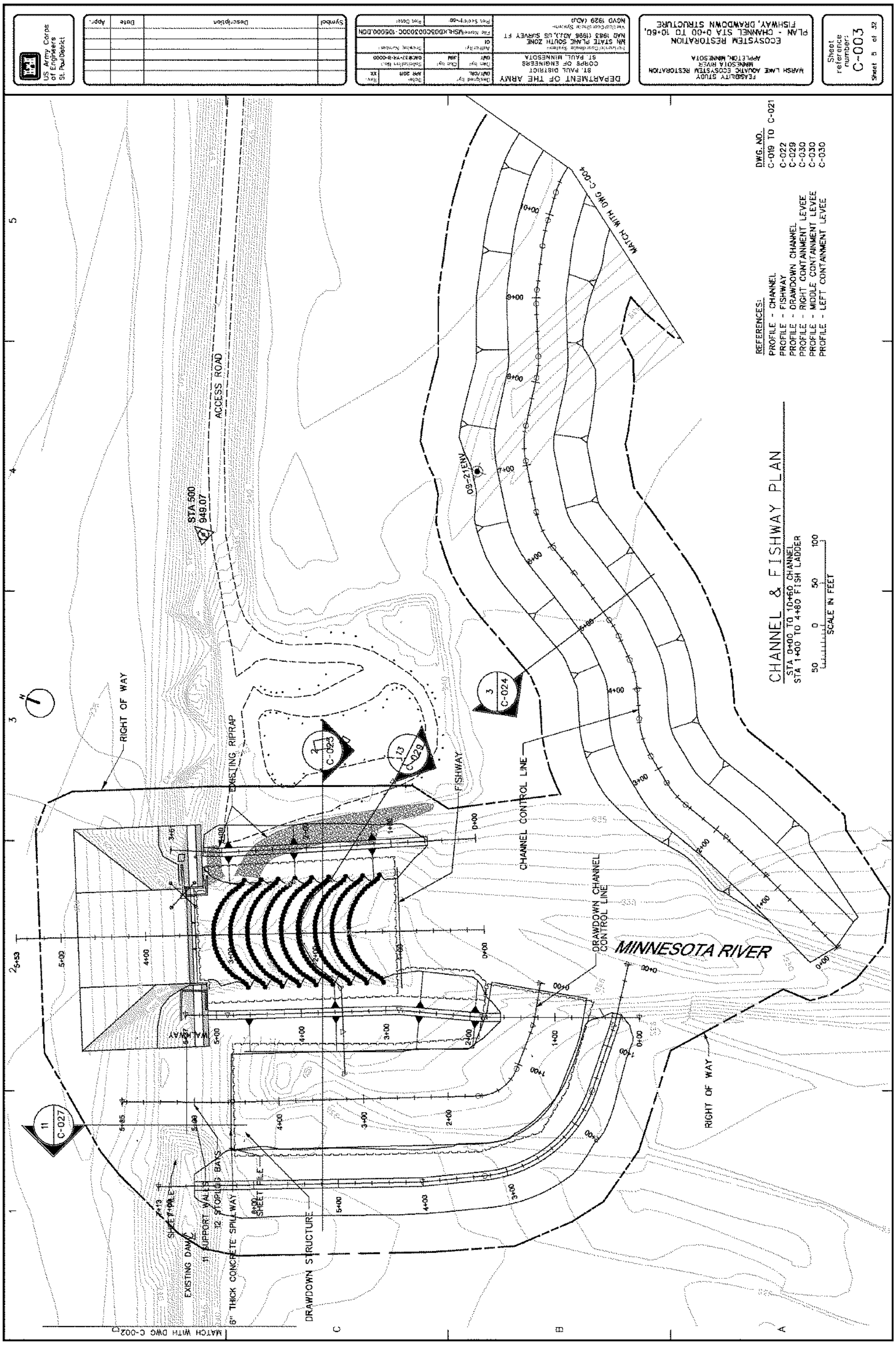
FEASIBILITY STUDY
MARSH LAKE AQUATIC ECOSYSTEM RESTORATION
MINNESOTA RIVER
APPLETON, MINNESOTA

ECOSYSTEM RESTORATION
DRAWING INDEX & LEGEND

Sheet reference number:
G-002
Sheet 2 of 32


US Army Corps of Engineers St. Paul District
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA
FEASIBILITY STUDY
MARSH LAKE AQUATIC ECOSYSTEM RESTORATION
MINNESOTA RIVER
APPLETON, MINNESOTA
ECOSYSTEM RESTORATION
GENERAL PLAN
Sheet reference number:
C-001
GENERAL PLAN
MARSH LAKE DAM
1500 0 1500 3000
SCALE IN FEET
M A R S H L A K E
A K R O N
A P P L E


US Army Corps of Engineers St. Paul District
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA
FEASIBILITY STUDY
MARSH LAKE AQUATIC ECOSYSTEM RESTORATION
MINNESOTA RIVER
APPLETON, MINNESOTA
ECOSYSTEM RESTORATION
PLAN & PROFILE - FISH POND
LEVEE BREACH STA 0+75 TO 1+77
Sheet reference number: C-002
Sheet 4 of 32
MATCH DWG C-003
ACCESS
RIGHT OF WAY
LEVEE CONTROL LINE
2+51
2+00
1+00
0+00
C-023
FISH POND LEVEE BREACH
STA 0+75 TO 1+77
SCALE IN FEET
EXISTING TOP OF LEVEE
ELEVATION
PROFILE
FISH POND LEVEE BREACH


CHANNEL & FISHWAY PLAN
STA 0+00 TO 10+60 CHANNEL
STA 1+00 TO 4+80 FISH LADDER
SCALE IN FEET
REFERENCES:
PROFILE - CHANNEL
PROFILE - FISHWAY
PROFILE - DRAWDOWN CHANNEL
PROFILE - RIGHT CONTAINMENT LEVEE
PROFILE - MIDDLE CONTAINMENT LEVEE
PROFILE - LEFT CONTAINMENT LEVEE
DWG. NO.
C-019 TO C-021
C-022
C-029
C-030
C-030
C-030
MINNESOTA RIVER
ACCESS ROAD
RIGHT OF WAY
EXISTING RIPRAP
FISHWAY
CHANNEL CONTROL LINE
DRAWDOWN CHANNEL CONTROL LINE
DRAWDOWN STRUCTURE
EXISTING DAM
6" THICK CONCRETE SPILLWAY
11 SUPPORT WALLS
12 STOPLOG BAYS
SHEET PILE
MATCH WITH DWG C-002
MATCH WITH DWG C-004
STA 500
949.07
US Army Corps of Engineers St. Paul District
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT
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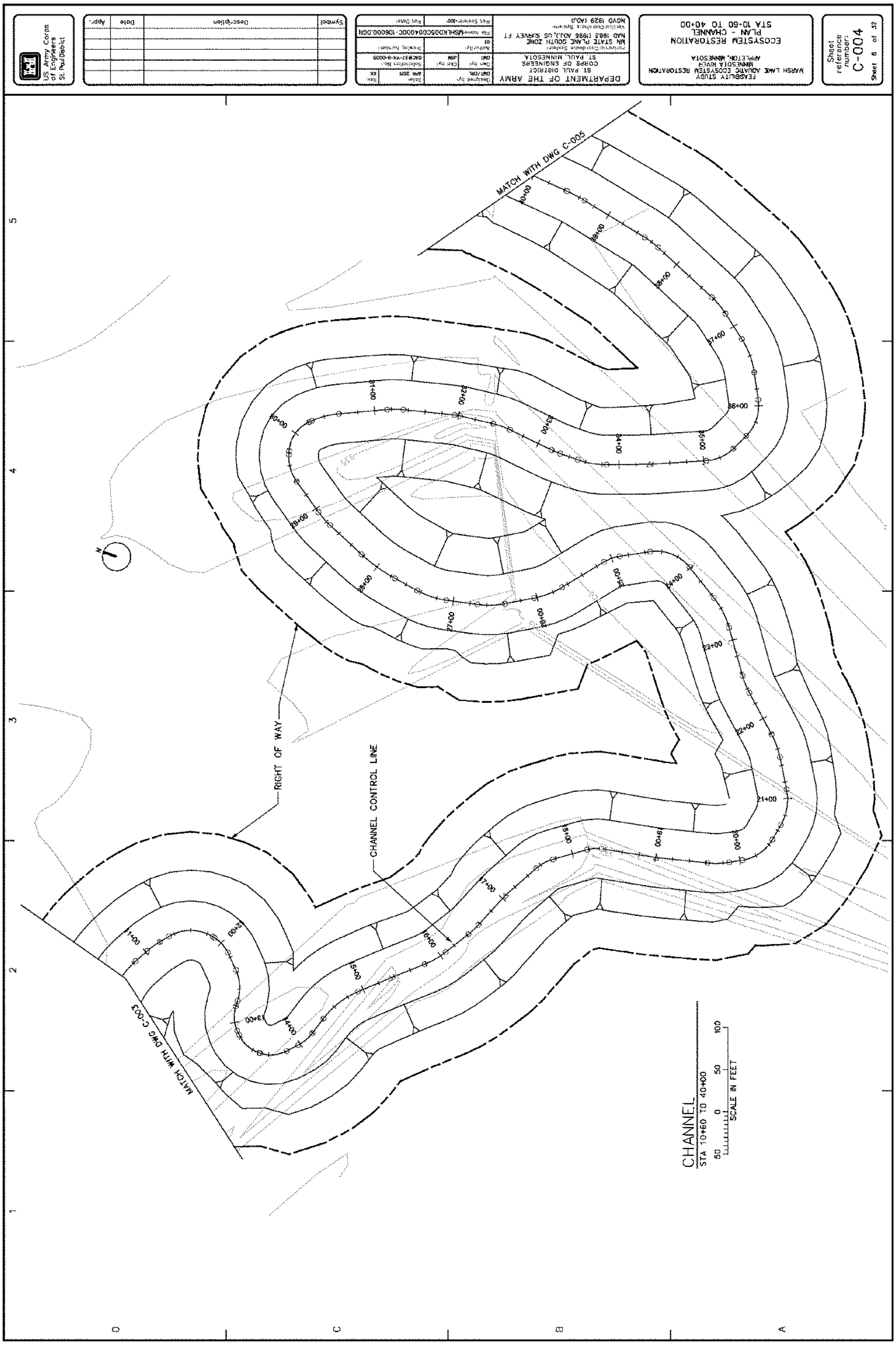
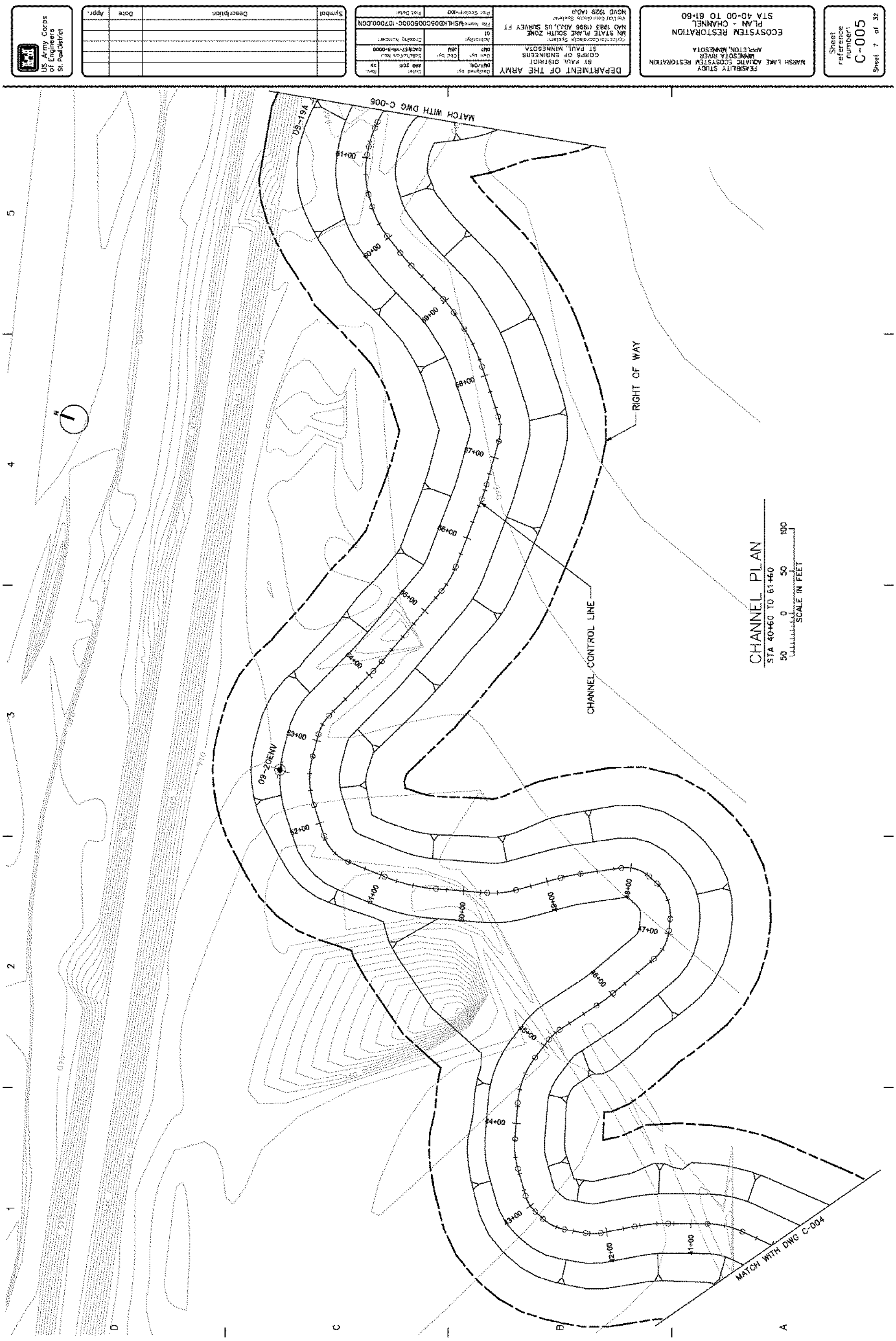
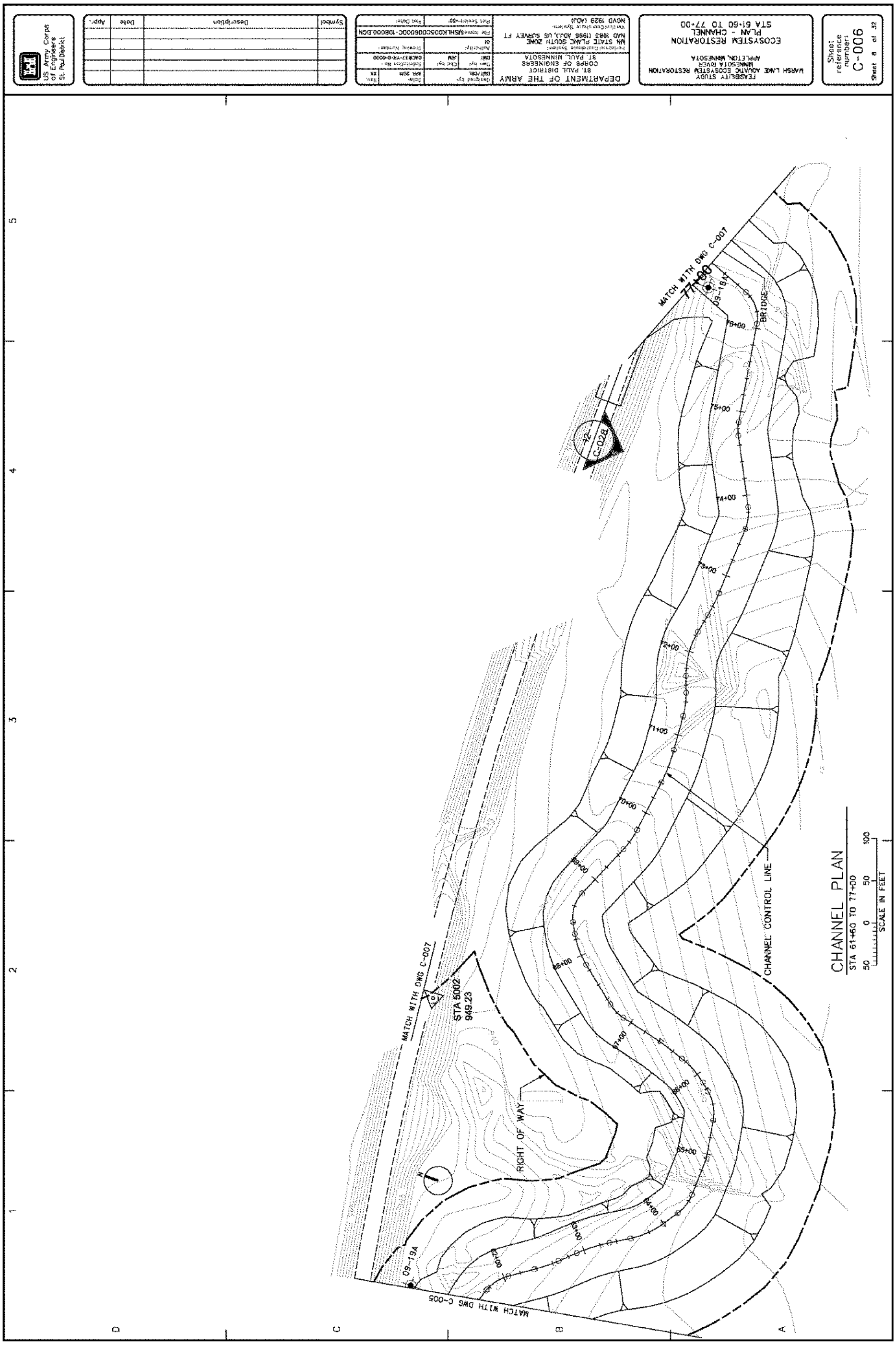
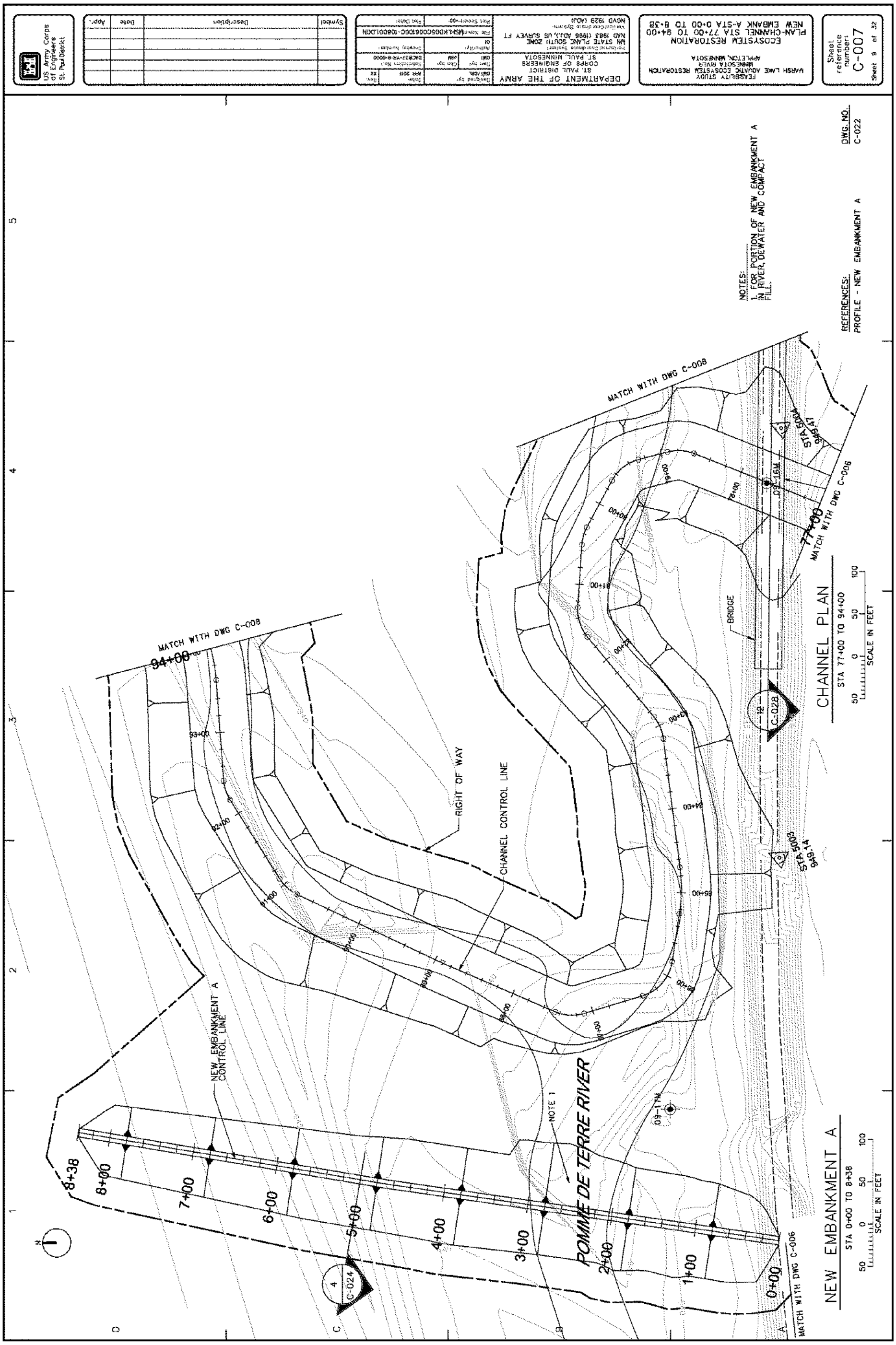
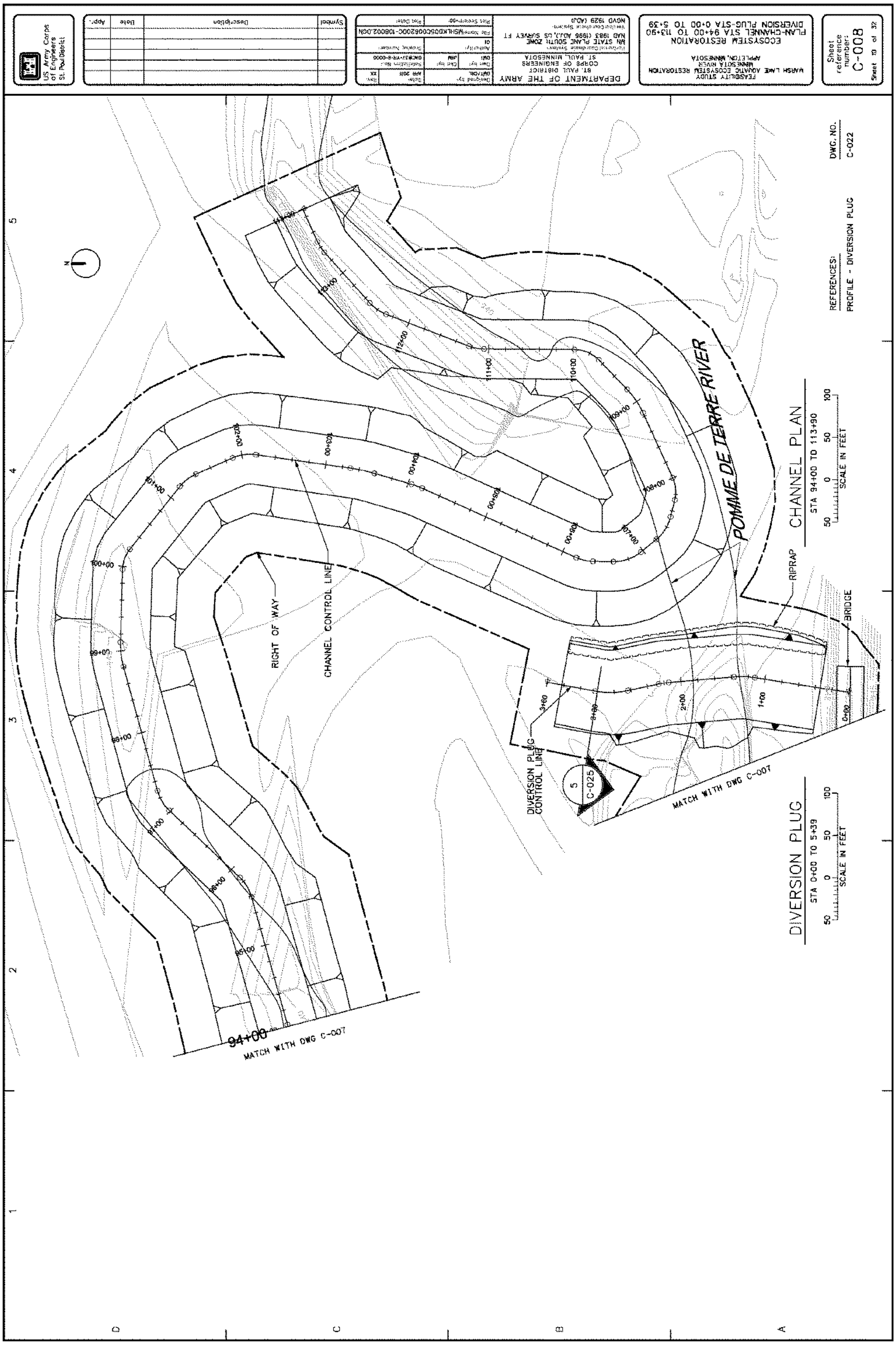
ST. PAUL, MINNESOTA
FEASIBILITY STUDY
MARSH LAKE AQUATIC ECOSYSTEM RESTORATION
MINNESOTA RIVER
APPLETON, MINNESOTA
ECOSYSTEM RESTORATION
PLAN - CHANNEL STA 0+00 TO 10+60,
FISHWAY, DRAWDOWN STRUCTURE
Sheet reference number:
C-003


US Army Corps of Engineers St. Paul District
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA
FEASIBILITY STUDY
MARSH LAKE AQUATIC ECOSYSTEM RESTORATION
ECOSYSTEM RESTORATION
PLAN - CHANNEL
STA 10+60 TO 40+00
C-004
MATCH WITH DWG C-005
MATCH WITH DWG C-003
RIGHT OF WAY
CHANNEL CONTROL LINE
CHANNEL
STA 10+60 TO 40+00
SCALE IN FEET


US Army Corps of Engineers St. Paul District
DEPARTMENT OF THE ARMY
ST PAUL DISTRICT
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA
FEASIBILITY STUDY
MARSH LAKE AQUATIC ECOSYSTEM RESTORATION
MINNESOTA RIVER
APPLETON, MINNESOTA
ECOSYSTEM RESTORATION
PLAN - CHANNEL
STA 40+00 TO 61+60
C-005
Sheet 7 of 32
MATCH WITH DWG C-006
MATCH WITH DWG C-004
RIGHT OF WAY
CHANNEL CONTROL LINE
CHANNEL PLAN
STA 40+60 TO 61+60
SCALE IN FEET


US Army Corps of Engineers St. Paul District
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA
FEASIBILITY STUDY
MARSH LAKE AQUATIC ECOSYSTEM RESTORATION
MINNESOTA RIVER
APPLETON, MINNESOTA
ECOSYSTEM RESTORATION
PLAN - CHANNEL
STA 61+60 TO 77+00
Sheet reference number:
C-006
CHANNEL PLAN
STA 61+60 TO 77+00
SCALE IN FEET
CHANNEL CONTROL LINE
RIGHT OF WAY
BRIDGE
MATCH WITH DWG C-007
MATCH WITH DWG C-005
STA 5002
949.23
09-19A


US Army Corps of Engineers St. Paul District
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA
NGVD 1929 (ADJ)
FEASIBILITY STUDY
MARSH LAKE AQUATIC ECOSYSTEM RESTORATION
MINNESOTA RIVER
APPLETON, MINNESOTA
ECOSYSTEM RESTORATION
PLAN-CHANNEL STA 77+00 TO 94+00
NEW EMBANKMENT A-STA 0+00 TO 8+38
Sheet reference number: C-007
Sheet 9 of 32
NOTES:
1. FOR PORTION OF NEW EMBANKMENT A IN RIVER, DEWATER AND COMPACT FILL.
REFERENCES:
PROFILE - NEW EMBANKMENT A
DWG. NO.
C-022
MATCH WITH DWG C-008
MATCH WITH DWG C-006
RIGHT OF WAY
CHANNEL CONTROL LINE
BRIDGE
NEW EMBANKMENT A CONTROL LINE
NOTE 1
POMME DE TERRE RIVER
STA 5003
949.14
STA 5004
949.47
CHANNEL PLAN
STA 77+00 TO 94+00
SCALE IN FEET
NEW EMBANKMENT A
STA 0+00 TO 8+38
SCALE IN FEET


US Army Corps of Engineers St. Paul District
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA
MN STATE PLANE SOUTH ZONE
NAD 1983 (1996 ADJ.) US SURVEY FT
NGVD 1929 (ADJ)
FEASIBILITY STUDY
MARSH LAKE AQUATIC ECOSYSTEM RESTORATION
MINNESOTA RIVER
APPLETON, MINNESOTA
ECOSYSTEM RESTORATION
PLAN-CHANNEL STA 94+00 TO 113+90
DIVERSION PLUG-STA 0+00 TO 5+39
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C-008
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C-022
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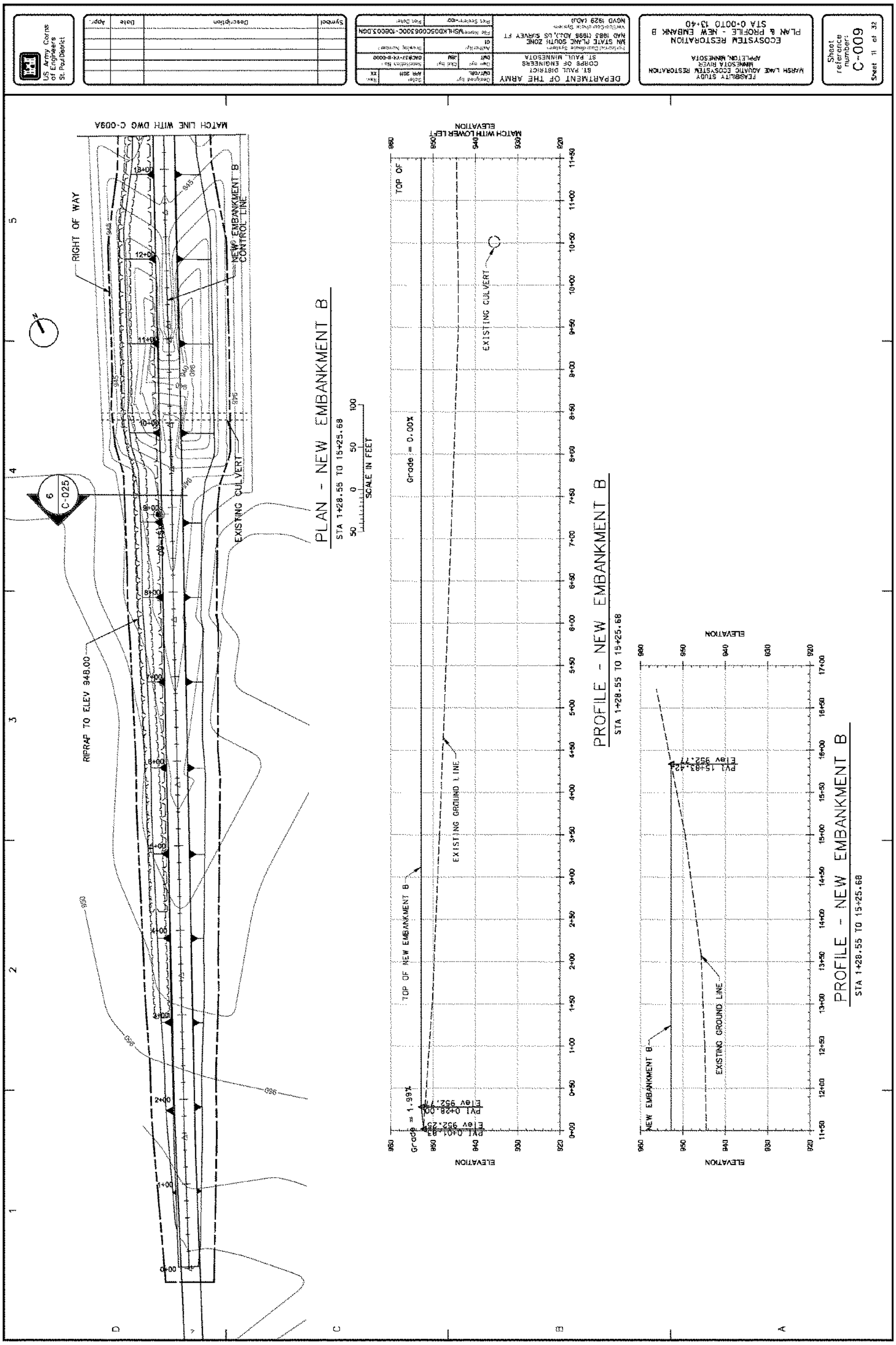
POMME DE TERRE RIVER
CHANNEL PLAN
STA 94+00 TO 113+90
SCALE IN FEET
DIVERSION PLUG
STA 0+00 TO 5+39
SCALE IN FEET
RIGHT OF WAY
CHANNEL CONTROL LINE
RIPRAP
BRIDGE
DIVERSION PLUG CONTROL LINE
MATCH WITH DWG C-007
94+00
MATCH WITH DWG C-007



US Army Corps of Engineers St. Paul District
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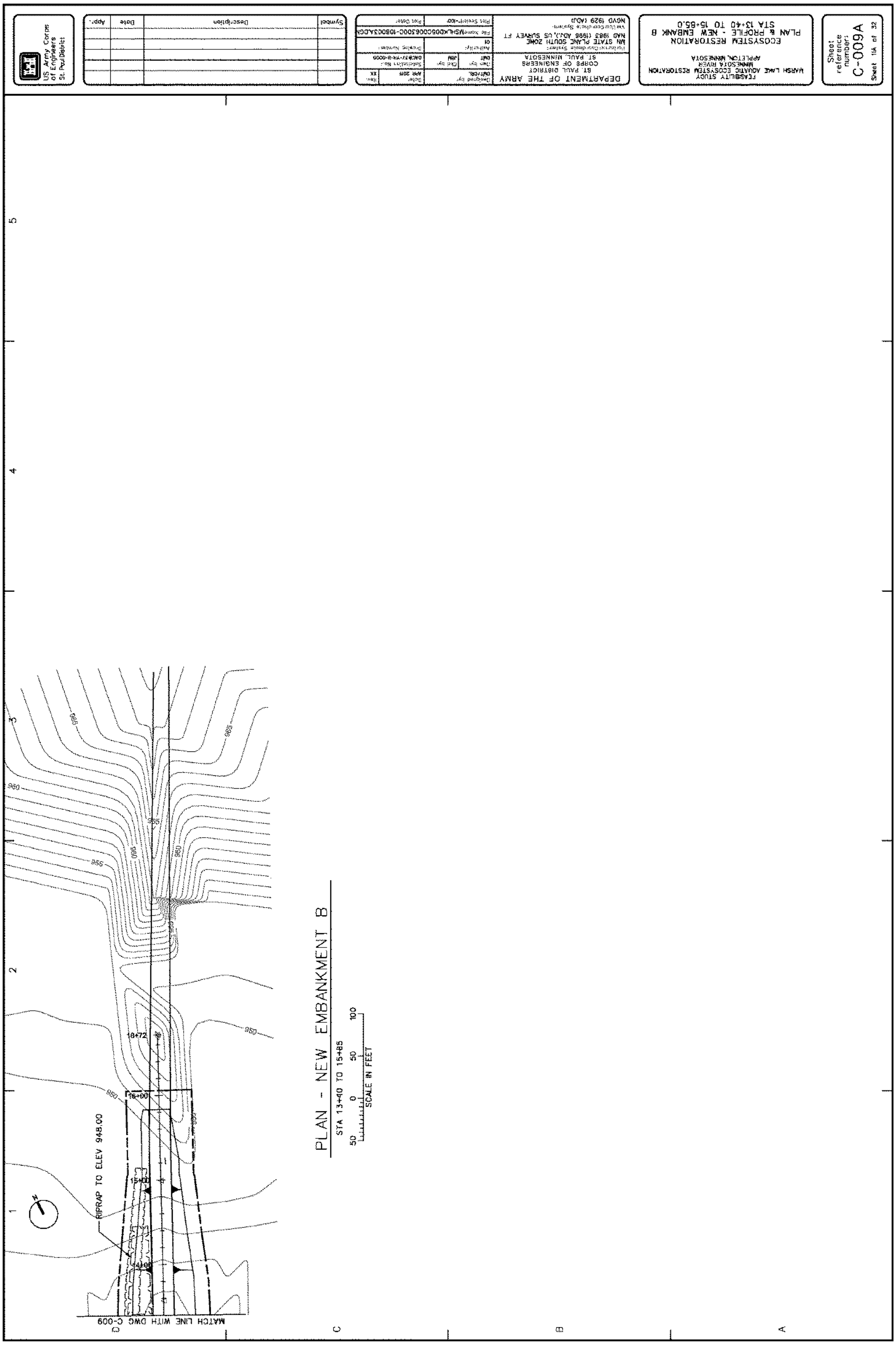
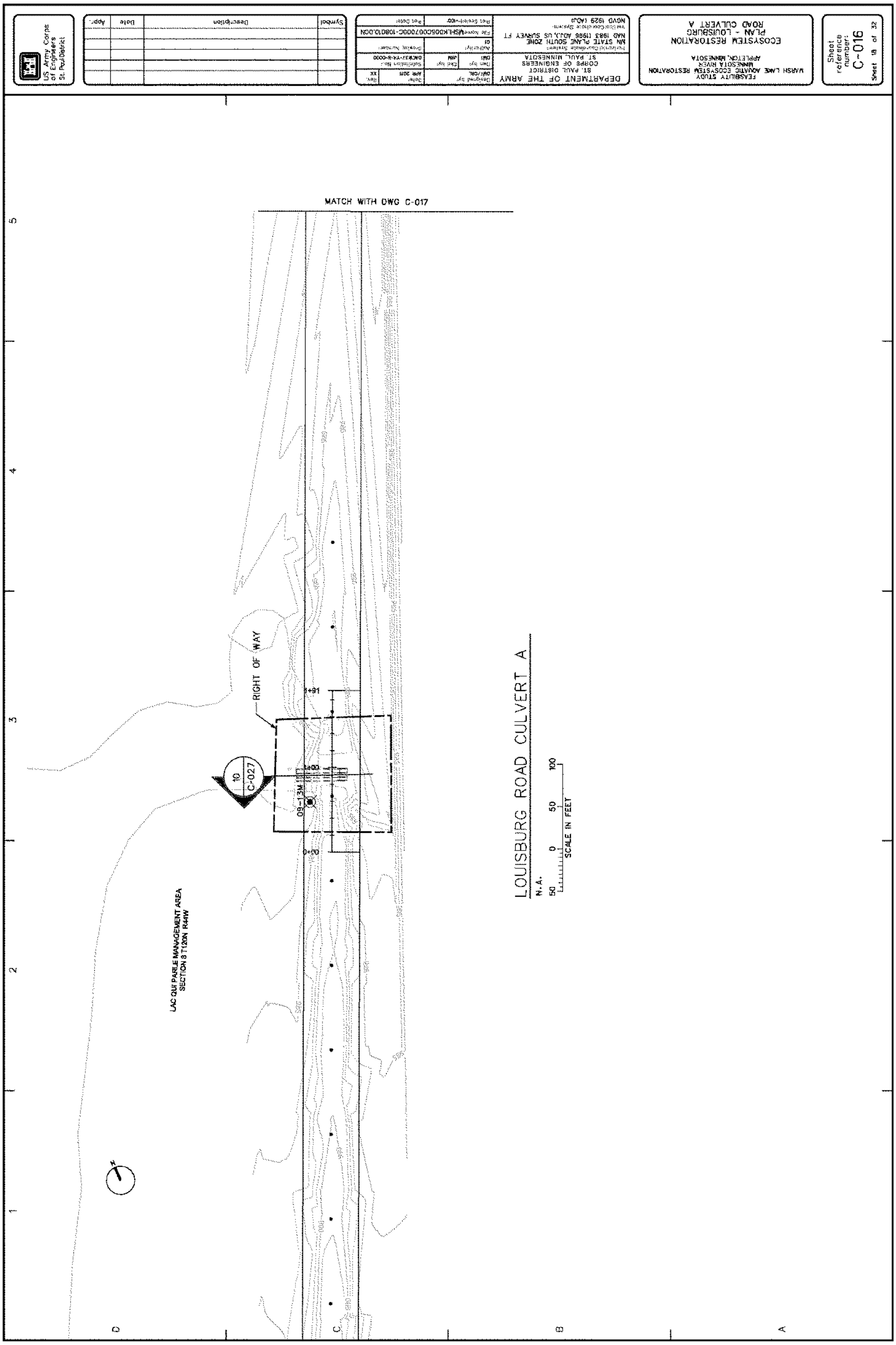
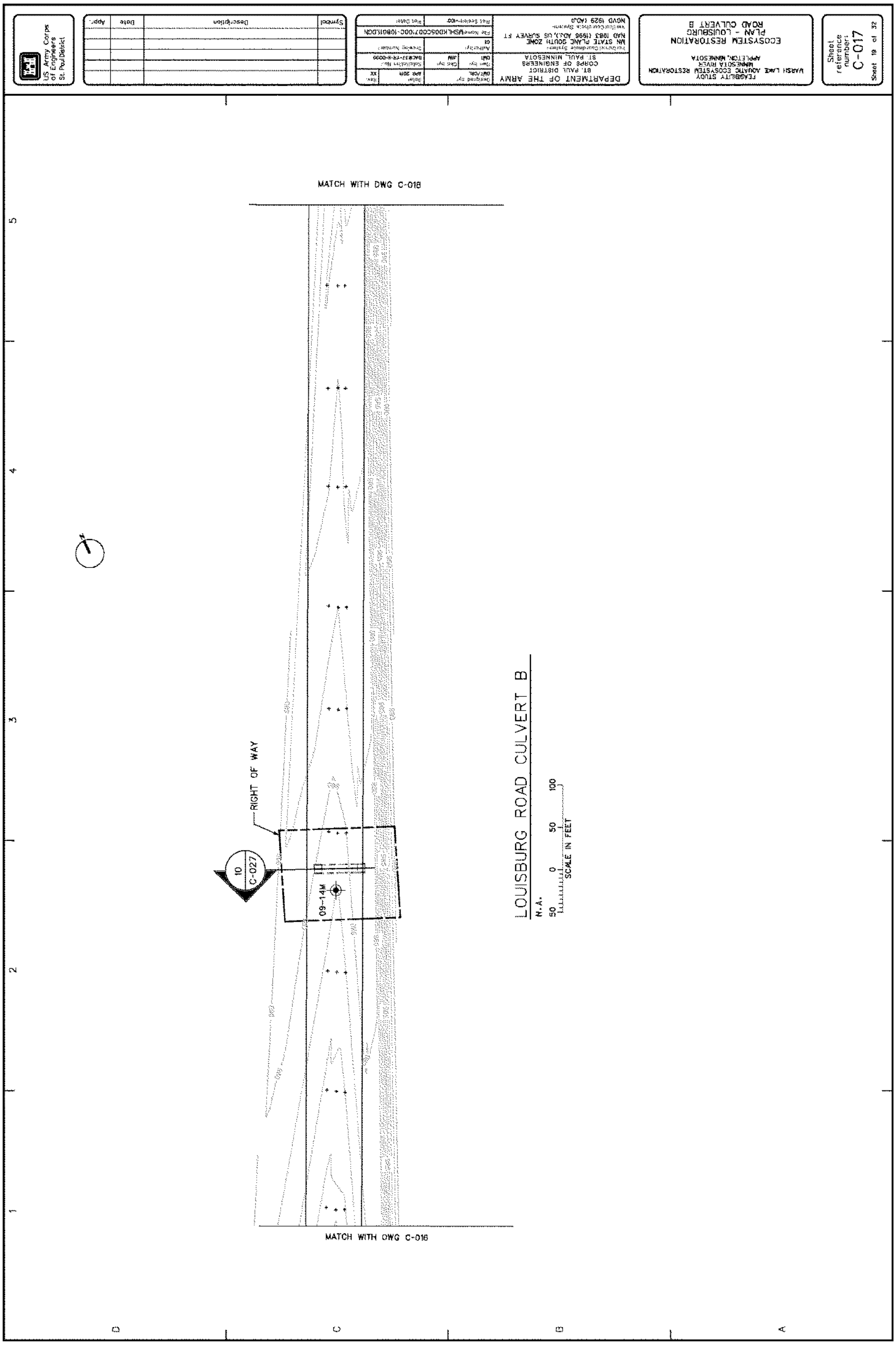
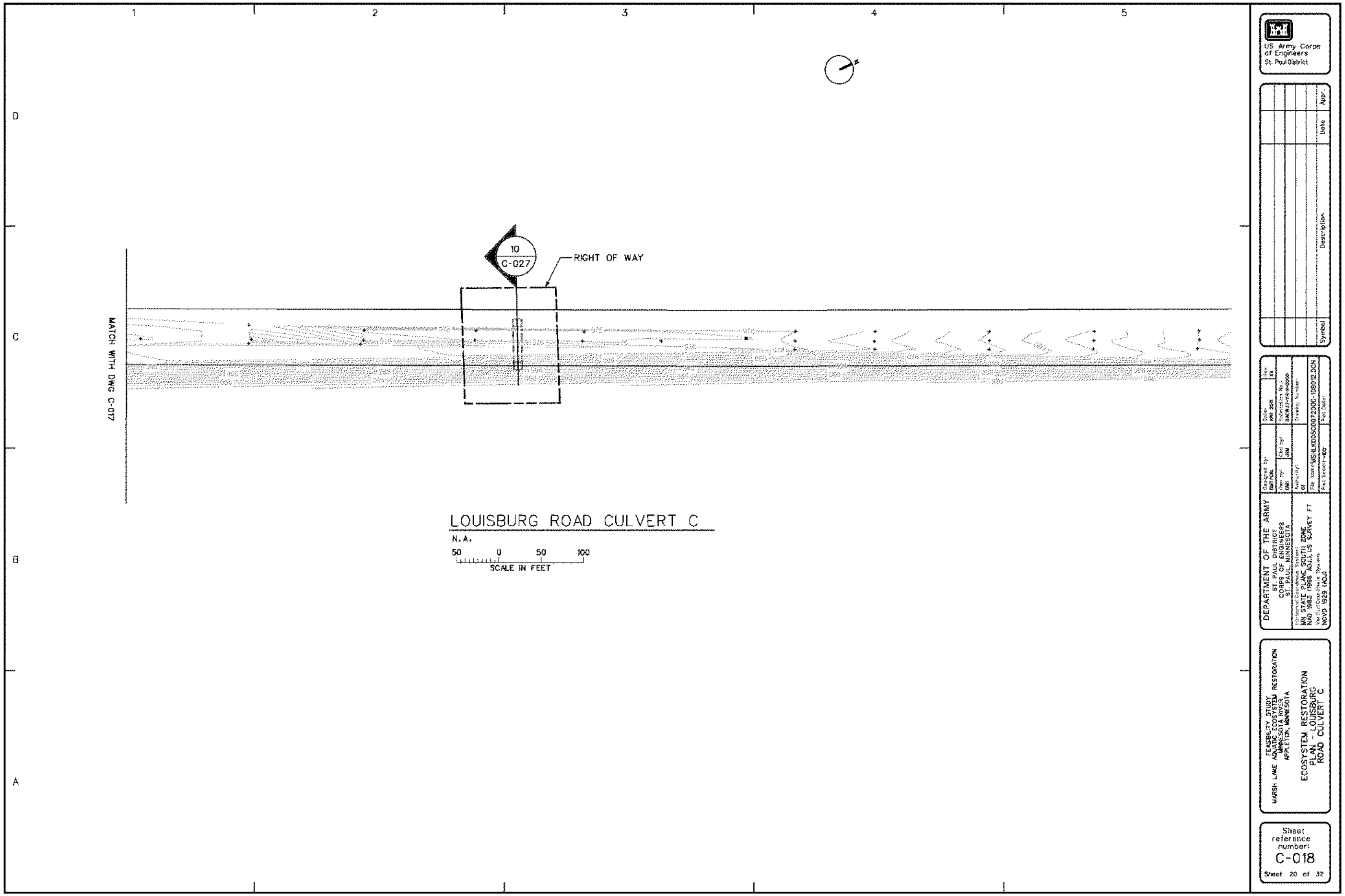
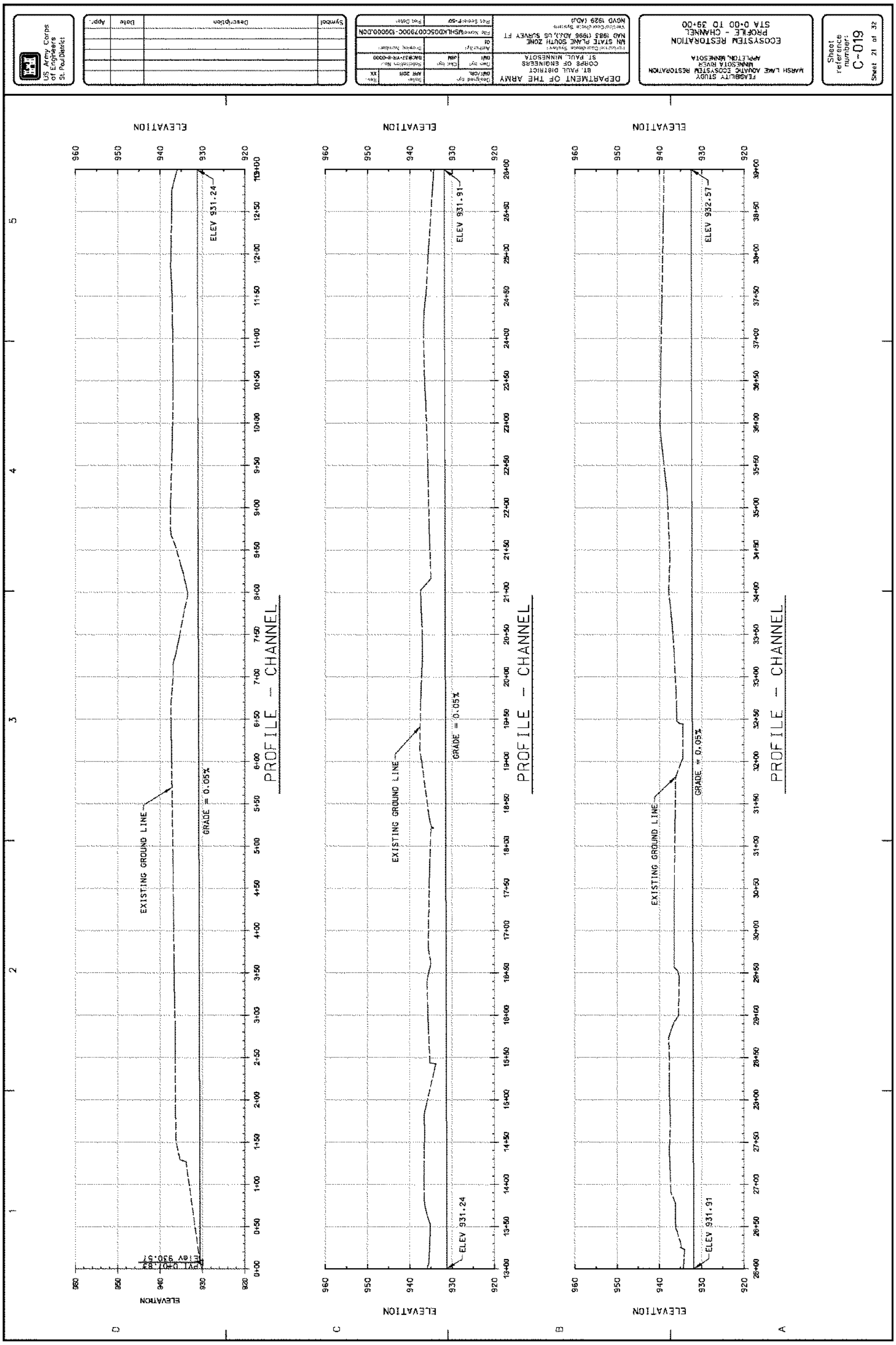
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA
FEASIBILITY STUDY
MARSH LAKE AQUATIC ECOSYSTEM RESTORATION
MINNESOTA RIVER
APPLETON, MINNESOTA
ECOSYSTEM RESTORATION
PLAN & PROFILE - NEW EMBANK B
STA 0+00TO 13+40
Sheet reference number:
C-009
MATCH LINE WITH DWG C-009A
RIGHT OF WAY
NEW EMBANKMENT B CONTROL LINE
EXISTING CULVERT
RIPRAP TO ELEV 948.00
C-025
PLAN - NEW EMBANKMENT B
STA 1+28.55 TO 15+25.68
SCALE IN FEET
PROFILE - NEW EMBANKMENT B
STA 1+28.55 TO 15+25.68
TOP OF NEW EMBANKMENT B
EXISTING GROUND LINE
Grade = 0.00%
ELEVATION
NEW EMBANKMENT B
PROFILE - NEW EMBANKMENT B
STA 1+28.55 TO 15+25.68


US Army Corps of Engineers St. Paul District
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA
NGVD 1929 (ADJ)
MN STATE PLANE SOUTH ZONE
NAD 1983 (1996 ADJ), US SURVEY FT
MARSH LAKE AQUATIC ECOSYSTEM RESTORATION
FEASIBILITY STUDY
MINNESOTA RIVER
APPLETON, MINNESOTA
ECOSYSTEM RESTORATION
PLAN & PROFILE - NEW EMBANK B
STA 13+40 TO 15+85.0
Sheet reference number: C-009A
PLAN - NEW EMBANKMENT B
STA 13+40 TO 15+85
SCALE IN FEET
RIPRAP TO ELEV 948.00
MATCH LINE WITH DWG C-009

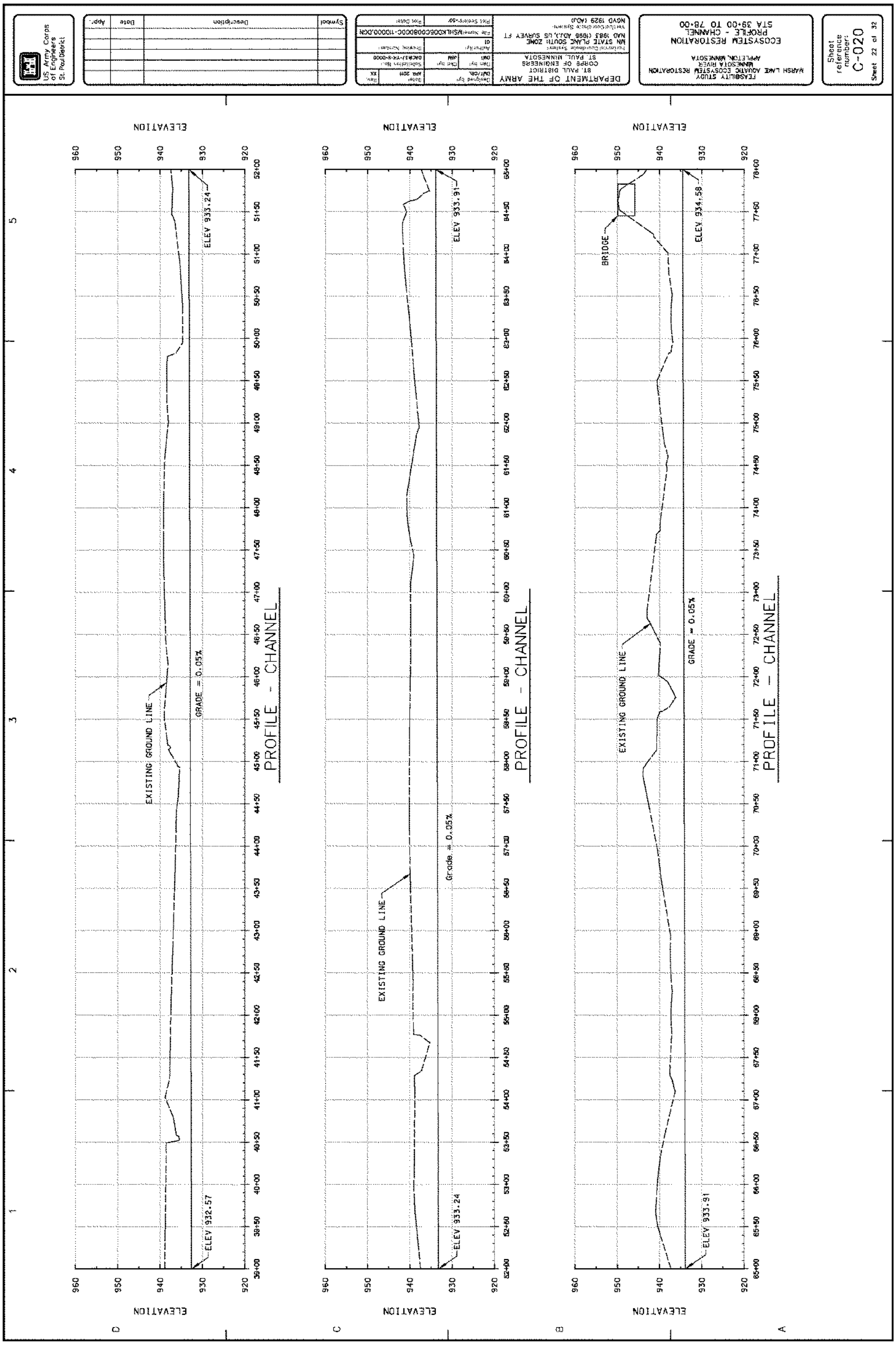

MATCH WITH DWG C-017
RIGHT OF WAY
10
C-027
09-13M
LAC QUI PARLE MANAGEMENT AREA
SECTION 8 T120N R44W
LOUISBURG ROAD CULVERT A
N.A.
50 0 50 100
SCALE IN FEET
US Army Corps of Engineers
St. Paul District
Symbol
Description
Date
Appr.
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA
MN STATE PLANE SOUTH ZONE
NAD 1983 (1986 ADJ.) US SURVEY FT
NGVD 1929 (ADJ)
FEASIBILITY STUDY
MARSH LAKE AQUATIC ECOSYSTEM RESTORATION
MINNESOTA RIVER
APPLETON, MINNESOTA
ECOSYSTEM RESTORATION
PLAN - LOUISBURG
ROAD CULVERT A
Sheet reference number:
C-016
Sheet 18 of 32

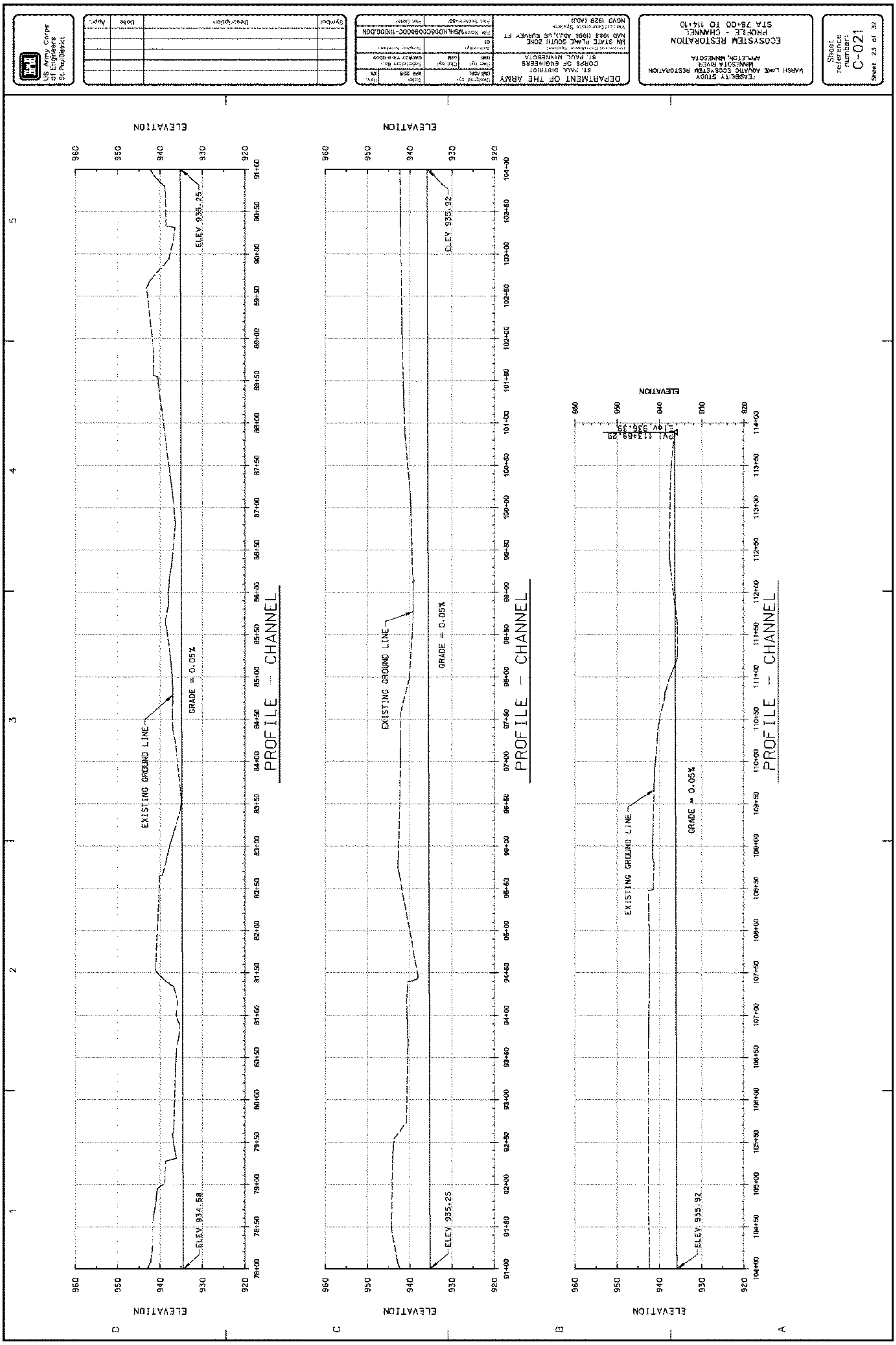

US Army Corps of Engineers St. Paul District
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA
FEASIBILITY STUDY
MARSH LAKE AQUATIC ECOSYSTEM RESTORATION
MINNESOTA RIVER
APPLETON, MINNESOTA
ECOSYSTEM RESTORATION
PLAN - LOUISBURG
ROAD CULVERT B
Sheet reference number: C-017
Sheet 19 of 32
MATCH WITH DWG C-018
RIGHT OF WAY
10
C-027
09-14M
LOUISBURG ROAD CULVERT B
N.A.
50 0 50 100
SCALE IN FEET
MATCH WITH DWG C-016

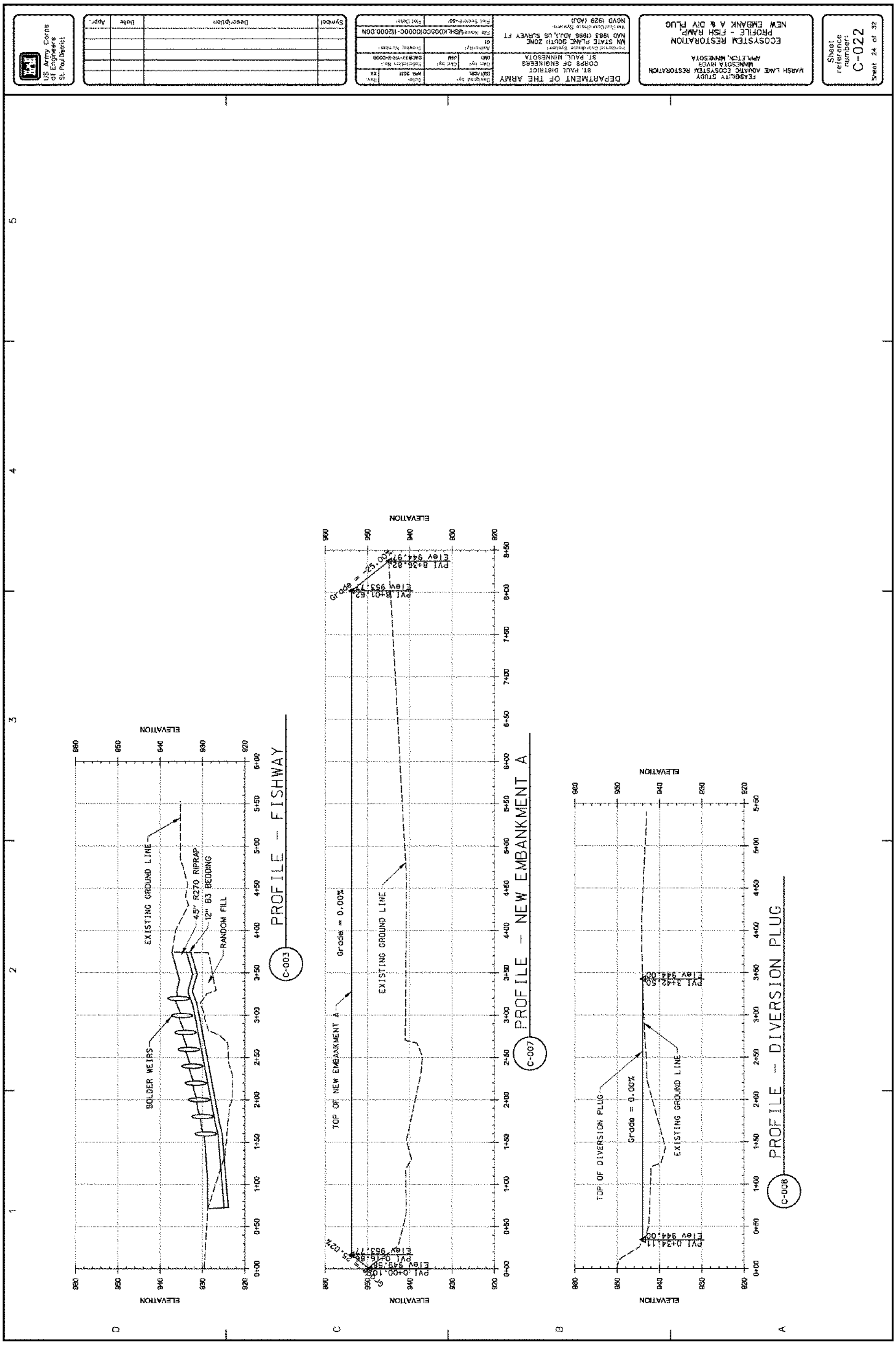

MATCH WITH DWG C-017
10
C-027
RIGHT OF WAY
LOUISBURG ROAD CULVERT C
N.A.
50 0 50 100
SCALE IN FEET
US Army Corps of Engineers St. Paul District
Symbol
Description
Date
Appr.
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA
MN STATE PLANE SOUTH ZONE
NAD 1983 (1996 ADJ.),US SURVEY FT
NGVD 1929 (ADJ)
FEASIBILITY STUDY
MARSH LAKE AQUATIC ECOSYSTEM RESTORATION
MINNESOTA RIVER
APPLETON, MINNESOTA
ECOSYSTEM RESTORATION
PLAN - LOUISBURG
ROAD CULVERT C
Sheet reference number:
C-018
Sheet 20 of 32

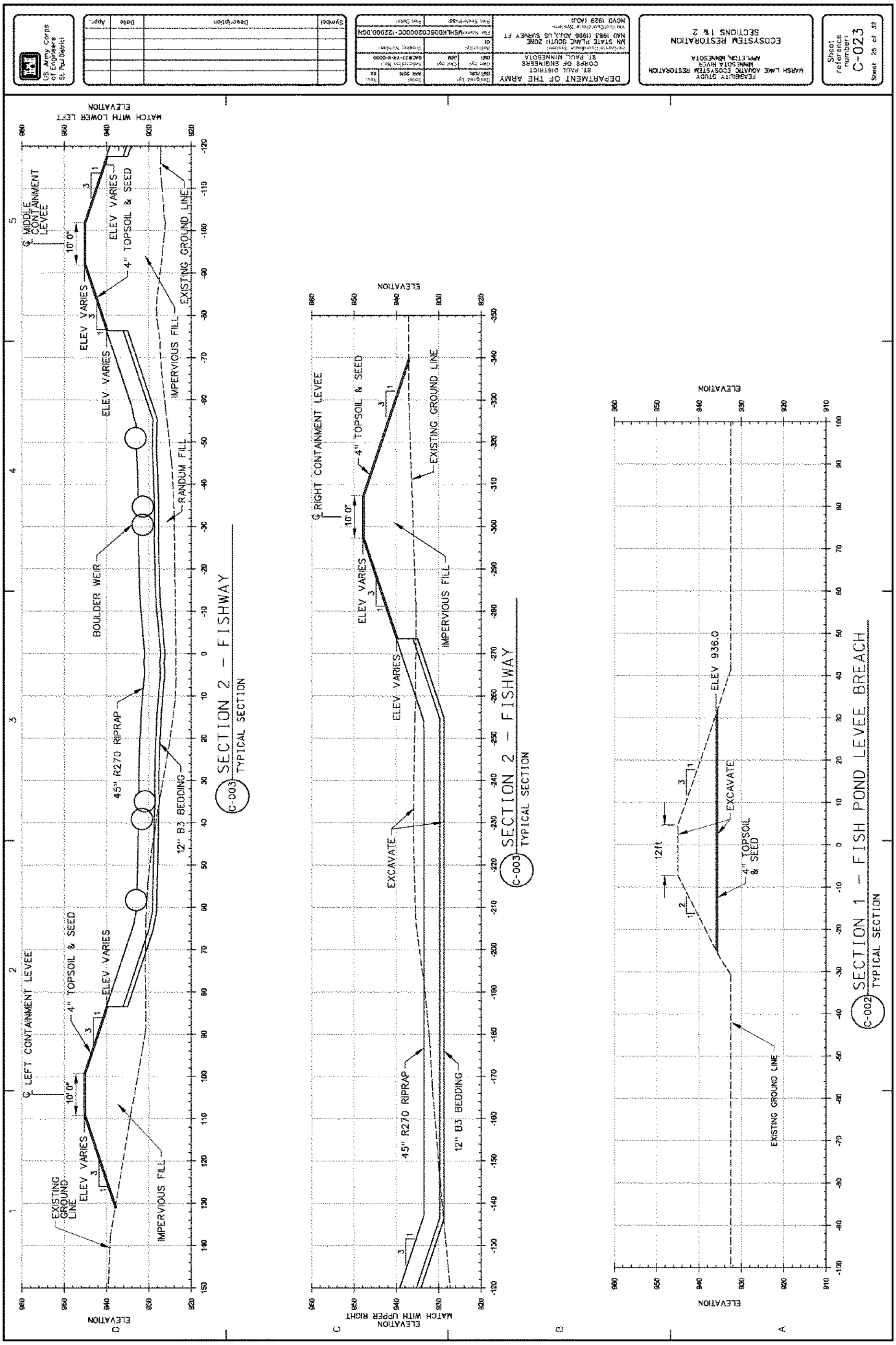


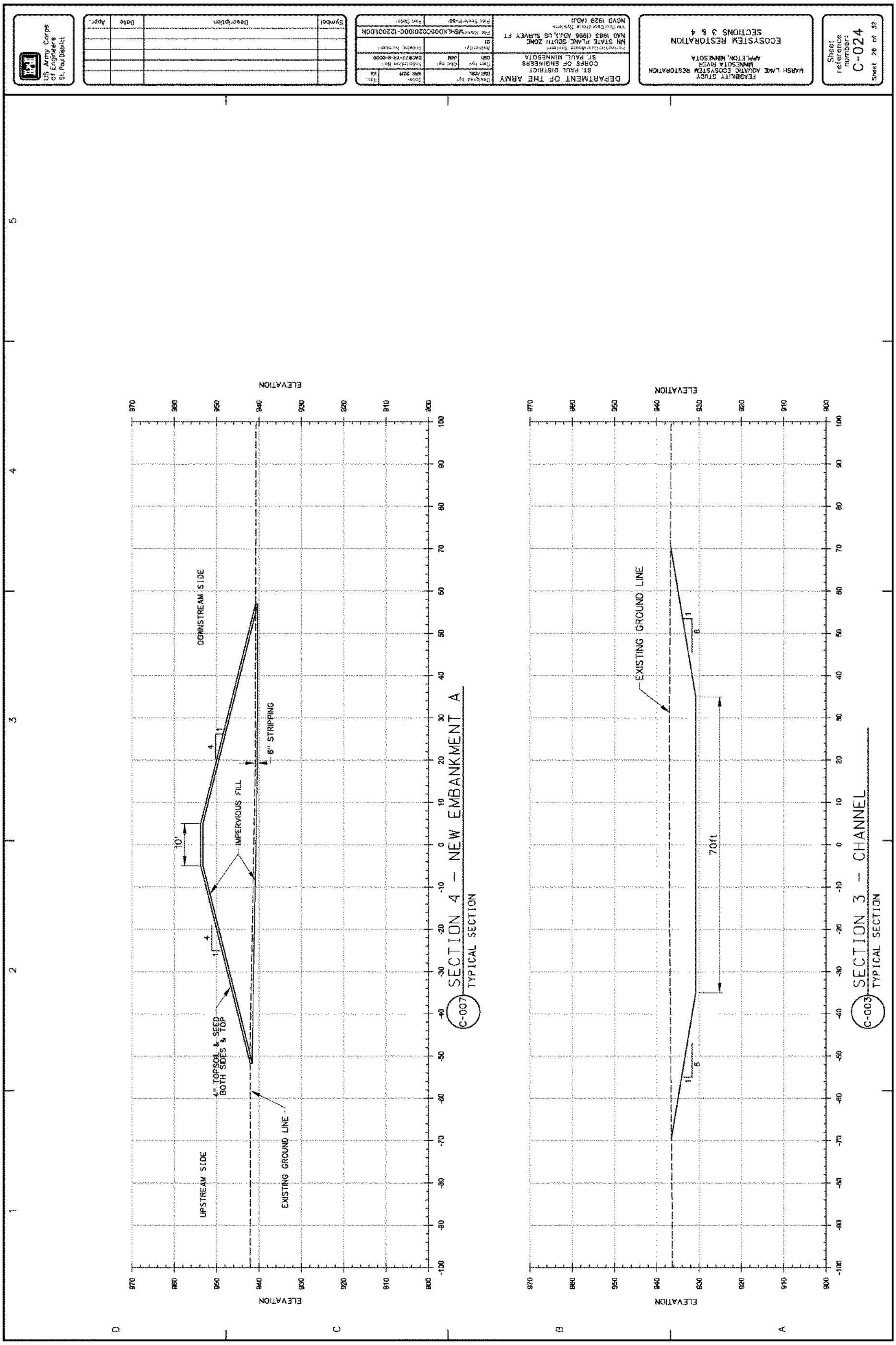
US Army Corps of Engineers St. Paul District
Symbol
Description
Date
Appr.
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA
MN STATE PLANE SOUTH ZONE
NAD 1983 (1996 ADJ), US SURVEY FT
NGVD 1929 (ADJ)
FEASIBILITY STUDY
MARSH LAKE AQUATIC ECOSYSTEM RESTORATION
MINNESOTA RIVER
APPLETON, MINNESOTA
ECOSYSTEM RESTORATION
PROFILE - CHANNEL
STA 0+00 TO 39+00
Sheet reference number:
C-019
Sheet 21 of 32
ELEVATION
EXISTING GROUND LINE
GRADE = 0.05%
PVI 0+01.83
Elev 930.57
ELEV 931.24
PROFILE - CHANNEL
ELEV 931.24
ELEV 931.91
PROFILE - CHANNEL
ELEV 931.91
ELEV 932.57
PROFILE - CHANNEL

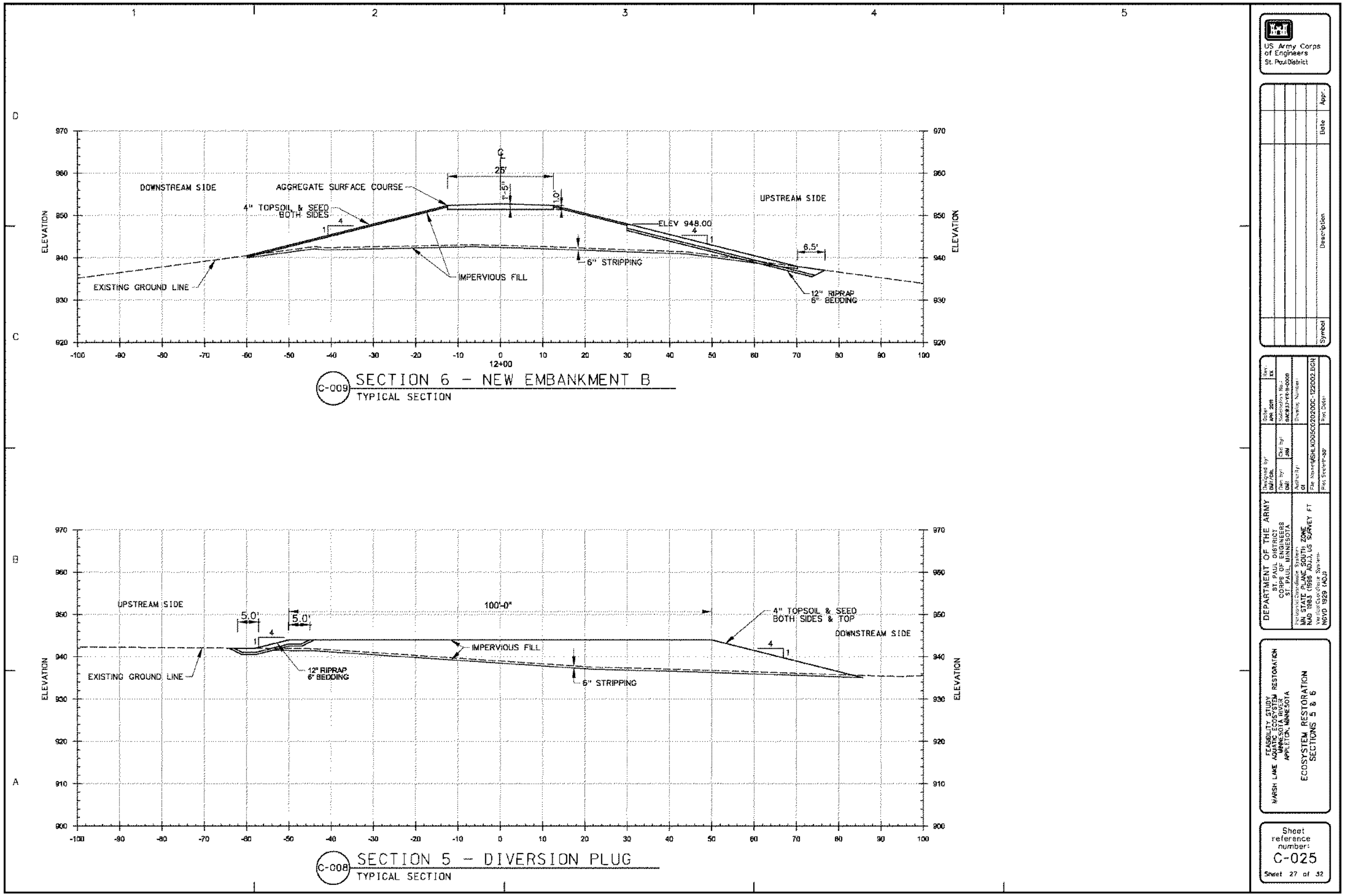

US Army Corps of Engineers St. Paul District
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA
FEASIBILITY STUDY
MARSH LAKE AQUATIC ECOSYSTEM RESTORATION
MINNESOTA RIVER
APPLETON, MINNESOTA
ECOSYSTEM RESTORATION
PROFILE - CHANNEL
STA 39+00 TO 78+00
Sheet reference number: C-020
Sheet 22 of 32
ELEVATION
EXISTING GROUND LINE
GRADE = 0.05%
ELEV 933.24
ELEV 932.57
ELEV 933.91
ELEV 934.58
BRIDGE
PROFILE - CHANNEL
PROFILE - CHANNEL
PROFILE - CHANNEL

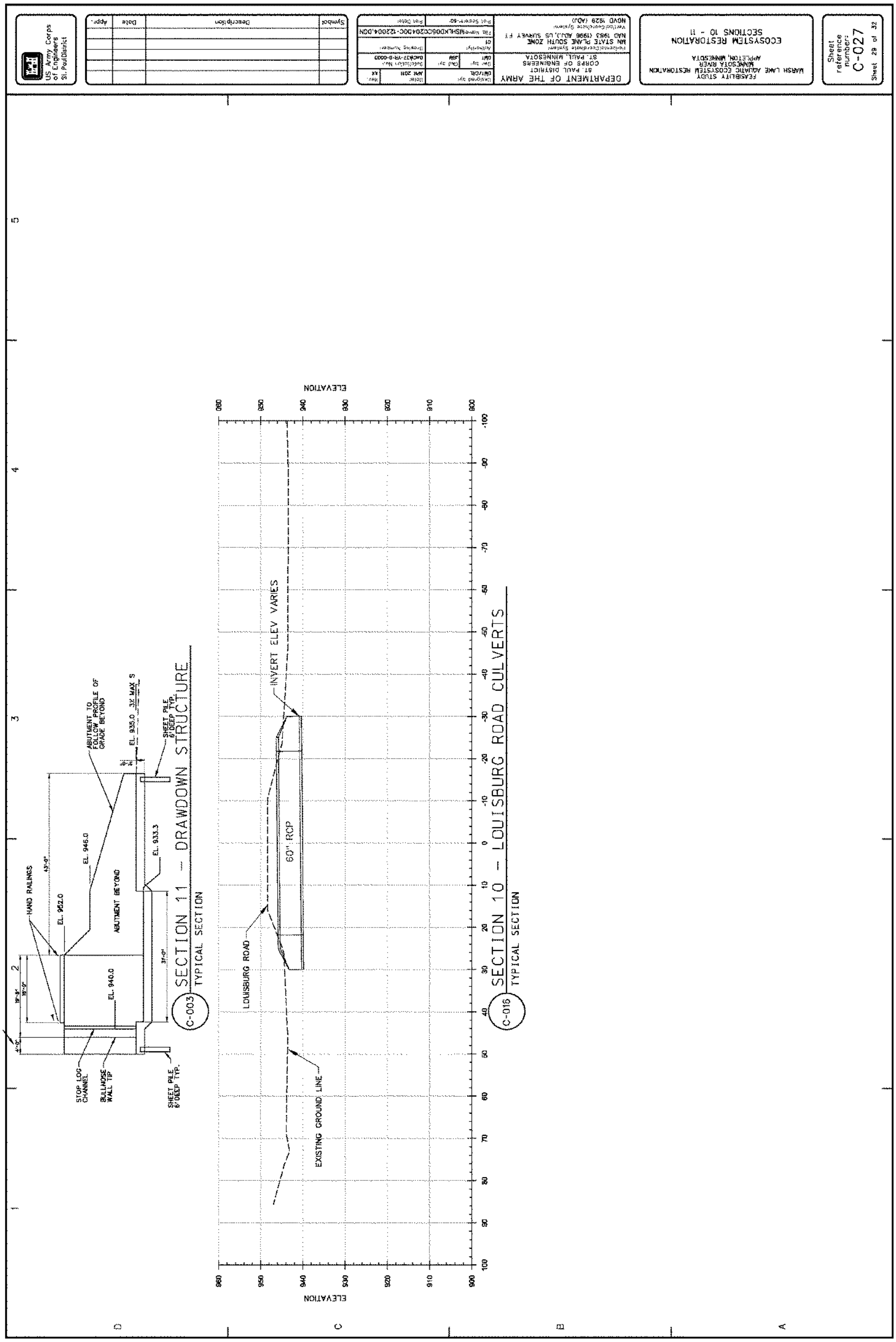

PROFILE - CHANNEL
PROFILE - CHANNEL
PROFILE - CHANNEL
EXISTING GROUND LINE
GRADE = 0.05%
ELEV 934.58
ELEV 935.25
ELEV 935.92
ELEVATION
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA
FEASIBILITY STUDY
MARSH LAKE AQUATIC ECOSYSTEM RESTORATION
MINNESOTA RIVER
APPLETON, MINNESOTA
ECOSYSTEM RESTORATION
PROFILE - CHANNEL
STA 78+00 TO 114+10
C-021
US Army Corps of Engineers
St. Paul District

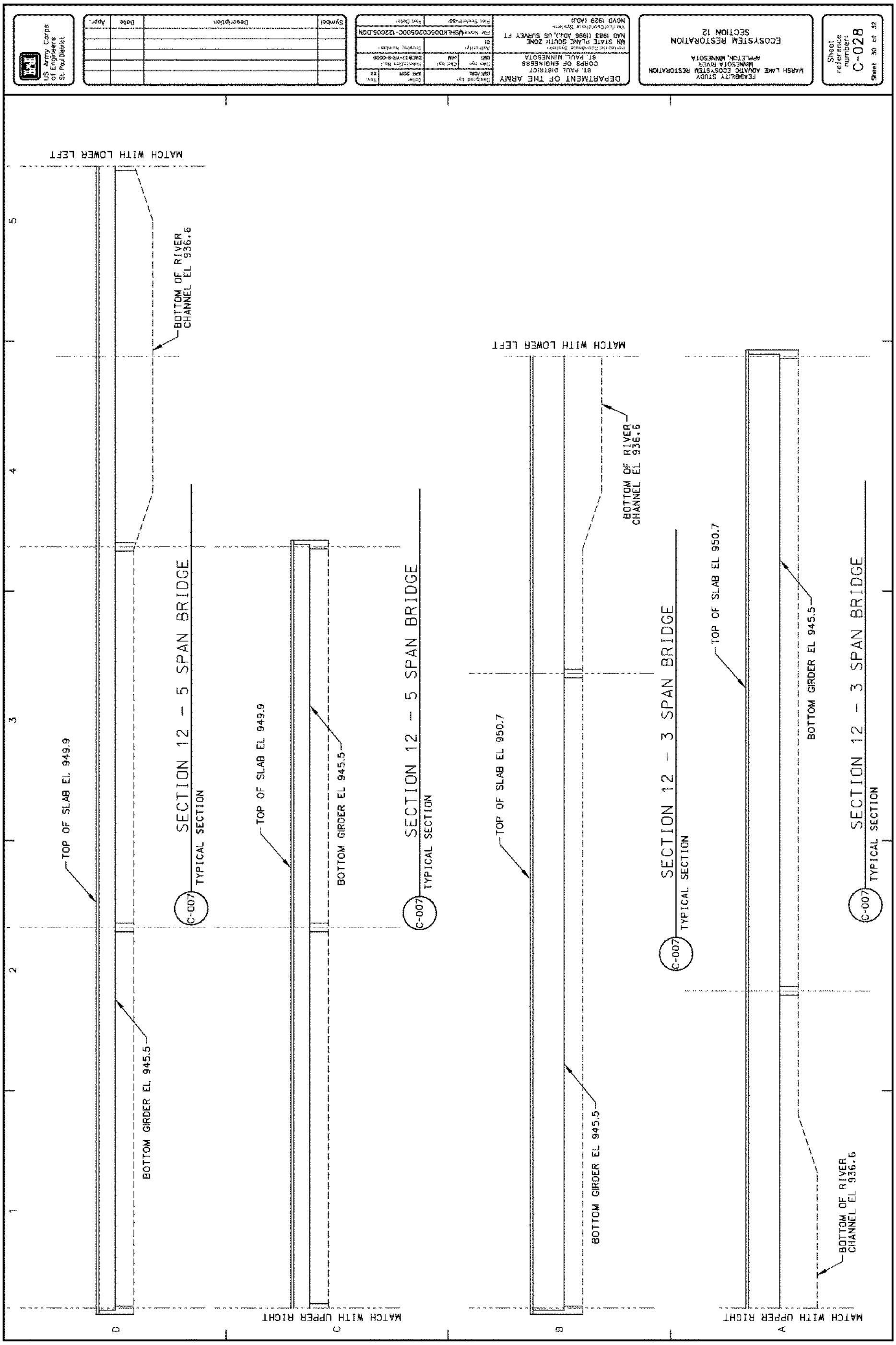

PROFILE - FISHWAY
EXISTING GROUND LINE
45" R270 RIPRAP
12" B3 BEDDING
RANDOM FILL
BOLDER WEIRS
PROFILE - NEW EMBANKMENT A
TOP OF NEW EMBANKMENT A
Grade = 0.00%
EXISTING GROUND LINE
PROFILE - DIVERSION PLUG
TOP OF DIVERSION PLUG
Grade = 0.00%
EXISTING GROUND LINE
ELEVATION
US Army Corps of Engineers St. Paul District
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA
FEASIBILITY STUDY
MARSH LAKE AQUATIC ECOSYSTEM RESTORATION
MINNESOTA RIVER
APPLETON, MINNESOTA
ECOSYSTEM RESTORATION
PROFILE - FISH RAMP,
NEW EMBANK A & DIV PLUG
Sheet reference number:
C-022
Sheet 24 of 32


US Army Corps of Engineers St. Paul District
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA
FEASIBILITY STUDY
MARSH LAKE AQUATIC ECOSYSTEM RESTORATION
MINNESOTA RIVER
APPLETON, MINNESOTA
ECOSYSTEM RESTORATION
SECTIONS 1 & 2
Sheet reference number:
C-023
ELEVATION
MATCH WITH LOWER LEFT
℄ MIDDLE CONTAINMENT LEVEE
℄ LEFT CONTAINMENT LEVEE
10' 0"
ELEV VARIES
4" TOPSOIL & SEED
EXISTING GROUND LINE
IMPERVIOUS FILL
RANDUM FILL
BOULDER WEIR
45" R270 RIPRAP
12" B3 BEDDING
C-003
SECTION 2 - FISHWAY
TYPICAL SECTION
MATCH WITH UPPER RIGHT
℄ RIGHT CONTAINMENT LEVEE
EXCAVATE
ELEV 936.0
12ft
C-002
SECTION 1 - FISH POND LEVEE BREACH
TYPICAL SECTION


US Army Corps of Engineers St. Paul District
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA
FEASIBILITY STUDY
MARSH LAKE AQUATIC ECOSYSTEM RESTORATION
MINNESOTA RIVER
APPLETON, MINNESOTA
ECOSYSTEM RESTORATION
SECTIONS 3 & 4
Sheet reference number:
C-024
SECTION 4 — NEW EMBANKMENT A
TYPICAL SECTION
C-007
DOWNSTREAM SIDE
UPSTREAM SIDE
10'
IMPERVIOUS FILL
6" STRIPPING
4" TOPSOIL & SEED BOTH SIDES & TOP
EXISTING GROUND LINE
ELEVATION
SECTION 3 — CHANNEL
TYPICAL SECTION
C-003
70ft
EXISTING GROUND LINE
ELEVATION


US Army Corps of Engineers St. Paul District
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA
FEASIBILITY STUDY
MARSH LAKE AQUATIC ECOSYSTEM RESTORATION
MINNESOTA RIVER
APPLETON, MINNESOTA
ECOSYSTEM RESTORATION
SECTIONS 5 & 6
Sheet reference number:
C-025
Sheet 27 of 32
DOWNSTREAM SIDE
UPSTREAM SIDE
AGGREGATE SURFACE COURSE
4" TOPSOIL & SEED BOTH SIDES
25'
1'-5"
1.0'
ELEV 948.00
6.5'
6" STRIPPING
IMPERVIOUS FILL
EXISTING GROUND LINE
12" RIPRAP 6" BEDDING
ELEVATION
12+00
C-009
SECTION 6 - NEW EMBANKMENT B
TYPICAL SECTION
UPSTREAM SIDE
5.0'
5.0'
100'-0"
4" TOPSOIL & SEED BOTH SIDES & TOP
DOWNSTREAM SIDE
IMPERVIOUS FILL
EXISTING GROUND LINE
12" RIPRAP 6" BEDDING
6" STRIPPING
ELEVATION
C-008
SECTION 5 - DIVERSION PLUG
TYPICAL SECTION


US Army Corps of Engineers St. Paul District
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA
FEASIBILITY STUDY
MARSH LAKE AQUATIC ECOSYSTEM RESTORATION
MINNESOTA RIVER
APPLETON, MINNESOTA
ECOSYSTEM RESTORATION
SECTIONS 10 - 11
Sheet reference number:
C-027
Sheet 29 of 32
HAND RAILINGS
EL. 952.0
EL. 946.0
STOP LOG CHANNEL
BULLNOSE WALL TIP
EL. 940.0
ABUTMENT BEYOND
ABUTMENT TO FOLLOW PROFILE OF GRADE BEYOND
EL. 935.0 .3% MAX S
EL. 933.3
SHEET PILE 6' DEEP TYP.
C-003
SECTION 11 - DRAWDOWN STRUCTURE
TYPICAL SECTION
LOUISBURG ROAD
INVERT ELEV VARIES
60" RCP
EXISTING GROUND LINE
ELEVATION
C-016
SECTION 10 - LOUISBURG ROAD CULVERTS
TYPICAL SECTION


US Army Corps of Engineers St. Paul District
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA
FEASIBILITY STUDY
MARSH LAKE AQUATIC ECOSYSTEM RESTORATION
MINNESOTA RIVER
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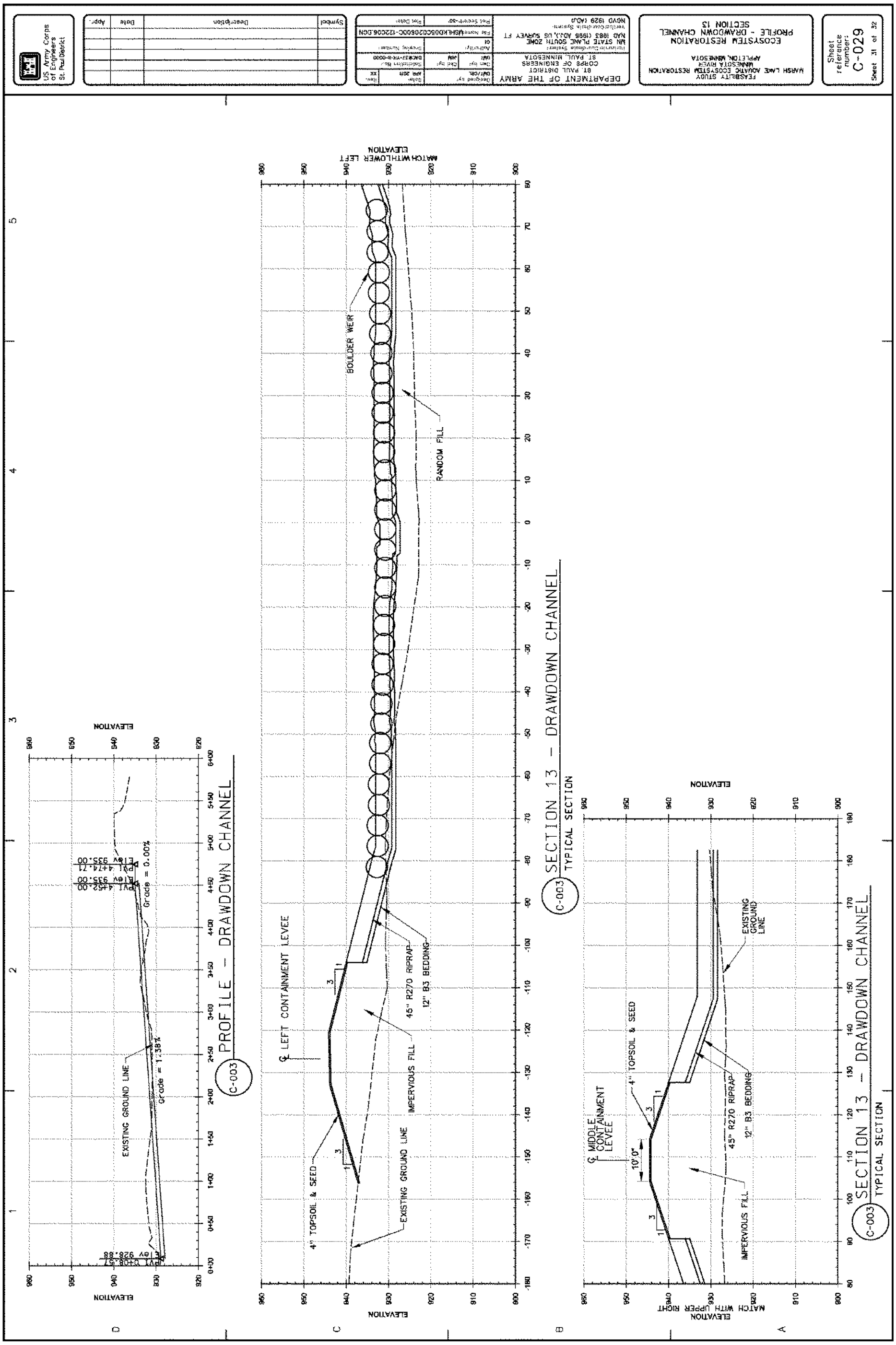
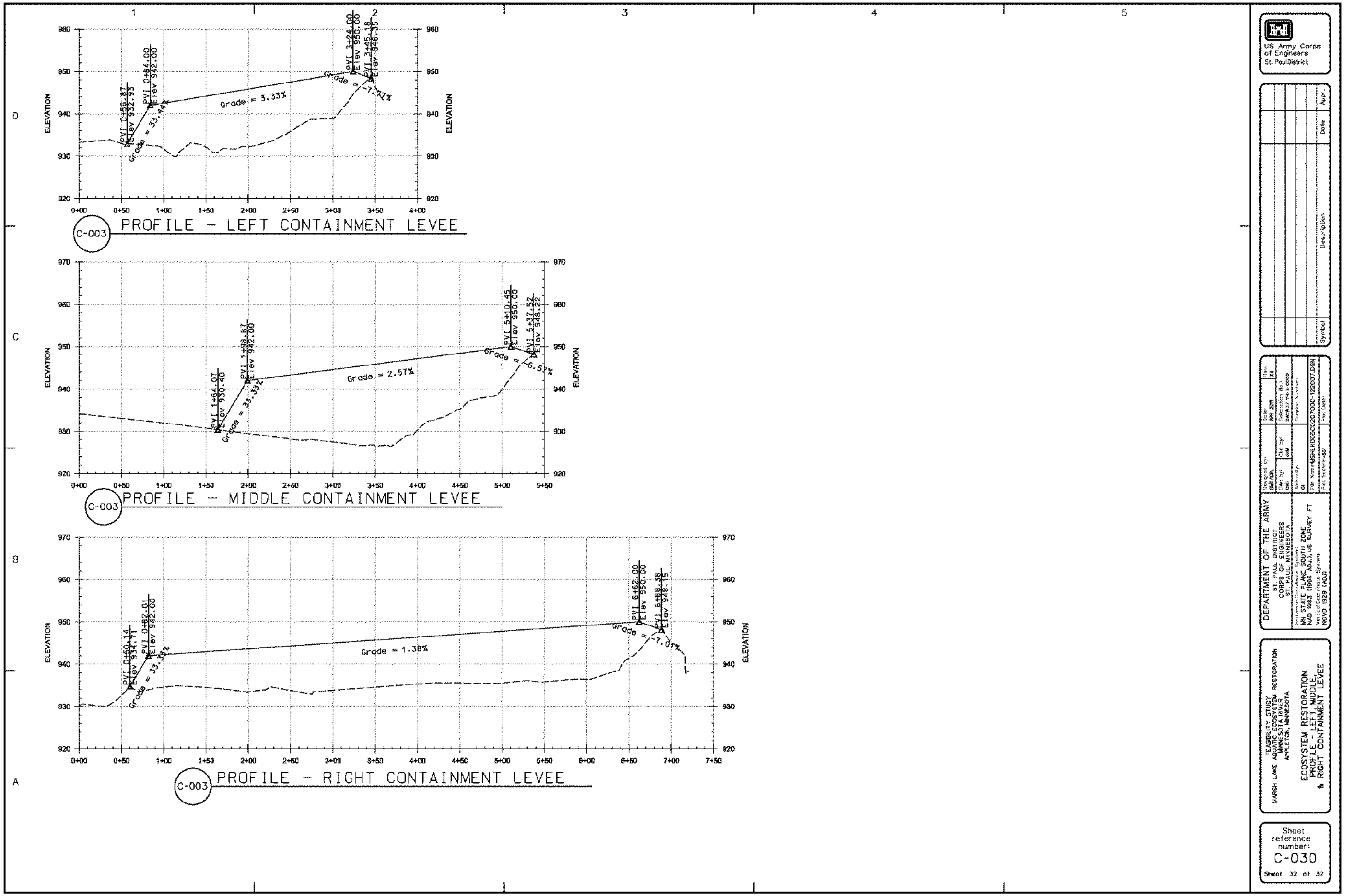
ECOSYSTEM RESTORATION
SECTION 12
Sheet reference number: C-028
Sheet 30 of 32
MATCH WITH LOWER LEFT
BOTTOM OF RIVER CHANNEL EL 936.6
TOP OF SLAB EL 949.9
BOTTOM GIRDER EL 945.5
SECTION 12 - 5 SPAN BRIDGE
C-007 TYPICAL SECTION
MATCH WITH UPPER RIGHT
TOP OF SLAB EL 949.9
BOTTOM GIRDER EL 945.5
SECTION 12 - 5 SPAN BRIDGE
C-007 TYPICAL SECTION
MATCH WITH LOWER LEFT
BOTTOM OF RIVER CHANNEL EL 936.6
TOP OF SLAB EL 950.7
BOTTOM GIRDER EL 945.5
SECTION 12 - 3 SPAN BRIDGE
C-007 TYPICAL SECTION
TOP OF SLAB EL 950.7
BOTTOM GIRDER EL 945.5
SECTION 12 - 3 SPAN BRIDGE
C-007 TYPICAL SECTION
BOTTOM OF RIVER CHANNEL EL 936.6
MATCH WITH UPPER RIGHT


PROFILE - DRAWDOWN CHANNEL
SECTION 13 - DRAWDOWN CHANNEL
TYPICAL SECTION
SECTION 13 - DRAWDOWN CHANNEL
TYPICAL SECTION
BOULDER WEIR
RANDOM FILL
LEFT CONTAINMENT LEVEE
45" R270 RIPRAP
12" B3 BEDDING
IMPERVIOUS FILL
EXISTING GROUND LINE
4" TOPSOIL & SEED
MIDDLE CONTAINMENT LEVEE
EXISTING GROUND LINE
ELEVATION
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA
C-029



PROFILE - LEFT CONTAINMENT LEVEE
C-003
PVI 0+56.87
Elev 932.93
PVI 0+84.00
Elev 942.00
Grade = 33.44%
Grade = 3.33%
PVI 3+24.00
Elev 950.00
PVI 3+45.18
Elev 948.35
Grade = -7.71%
PROFILE - MIDDLE CONTAINMENT LEVEE
C-003
PVI 1+64.07
Elev 930.40
PVI 1+98.87
Elev 942.00
Grade = 33.33%
Grade = 2.57%
PVI 5+10.45
Elev 950.00
PVI 5+37.52
Elev 948.22
Grade = -6.57%
PROFILE - RIGHT CONTAINMENT LEVEE
C-003
PVI 0+60.14
Elev 934.71
PVI 0+82.01
Elev 942.00
Grade = 33.33%
Grade = 1.38%
PVI 6+62.00
Elev 950.00
PVI 6+88.38
Elev 948.15
Grade = -7.01%
ELEVATION
US Army Corps of Engineers
St. Paul District
Symbol
Description
Date
Appr.
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA
MN STATE PLANE SOUTH ZONE
NAD 1983 (1996 ADJ.) US SURVEY FT
NGVD 1929 (ADJ)
FEASIBILITY STUDY
MARSH LAKE AQUATIC ECOSYSTEM RESTORATION
MINNESOTA RIVER
APPLETON, MINNESOTA
ECOSYSTEM RESTORATION
PROFILE - LEFT, MIDDLE,
& RIGHT CONTAINMENT LEVEE
Sheet reference number:
C-030
Sheet 32 of 32

Appendix O

Appendix O
Public and Private Summarized Comments and Corps Responses

Marsh Lake Ecosystem Restoration Project

Final Feasibility Report and Environmental Assessment

July 2011

US Army Corps of Engineers®

Prepared by:
U.S. Army Corps of Engineers
St. Paul District
180 Fifth Street East, Suite 700
St. Paul, Minnesota 55101-1678

Appendix O
Public and Private Summarized Comments and Corps Responses

Table of Contents

Written Comments Received During Feasibility Study Development

Included below are comments received during the plan formulation process for the study. Comments include the following:

1. March 10, 2006 letter from Ducks Unlimited to Minnesota Department of Natural Resources

2. February 11, 2008 letter from Ducks Unlimited to Minnesota Department of Natural Resources

Both letters are supportive of the study and the plan formulation process. No formal responses are provided to these two comment letters.

DUCKS UNLIMITED

Ryan P. Heiniger
Director of Conservation Programs – MN/IA

10075 208TH STREET WEST • LAKEVILLE • MINNESOTA • (952) 469-0956 OFFICE • (952) 807-8769 MOBILE • www.ducks.org

March 10, 2006

Cheryl Heide
Minnesota Department of Natural Resources
261 Highway 15 South
New Ulm, MN 56073

Dear Ms. Heide:

As you know, Ducks Unlimited has recently begun a comprehensive program called the *Living Lakes Initiative*, a science-based, strategic effort to reverse the decline of migratory waterfowl and our waterfowling heritage in Minnesota. Marsh Lake is an important part of one of the key focus areas in our Living Lakes Initiative and we are fully supportive of efforts designed to improve Marsh Lake.

The volunteers and staff of Ducks Unlimited, Inc. fully support the Minnesota Department of Natural Resources efforts to collaborate with the U.S. Army Corps of Engineers to improve Marsh Lake for waterfowl and other wildlife. Marsh Lake represents a remarkable natural resource and desperately needs a timely public investment by the U.S. Army Corp of Engineers and other partners to restore the area for waterfowl habitat, flood storage retention, and improving water quality in the Minnesota River.

It is our understanding that a funding request for appropriations within the fiscal year 2007 Energy and Water Development Act for the U.S. Army Corps of Engineers are being pursued. Furthermore, the current effort targets appropriations for the completion of a feasibility study with a projected federal cost of $258,000, which will be leveraged with state resources.

Please feel free to contact me if you have any questions or concerns.

Sincerely,

Ryan Heiniger
Director of Conservation Programs – Minnesota/Iowa

Cc: Congressman Peterson, Senator Coleman, Senator Dayton
Mark Holsten – MN DNR

DUCKS UNLIMITED

Ryan P. Heiniger
Director of Conservation Programs – MN/IA

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February 11, 2008

Mark Matuska, Regional Director
Minnesota Department of Natural Resources
261 Highway 15 South
New Ulm, MN 56073

Dear Mr. Matuska:

RE: Support for Marsh Lake Study

Ducks Unlimited, Inc. (DU) fully supports the fiscal year 2009 Congressional appropriation request of $250,000 to complete the planning phase of the Marsh Lake Ecosystem Restoration Feasibility Study. DU has been pleased to be a partner in the planning process in cooperation with the Minnesota Department of Natural Resources, the U.S. Army Corps of Engineers and other stakeholders.

Marsh Lake is a remarkable natural resource for waterfowl, other wildlife and the citizens of Minnesota. As you know, through Ducks Unlimited's Living Lakes Initiative in Minnesota and Iowa, we are focused on restoring the ecological health of shallow lakes. This is a science-based, partnership driven effort to reverse the decline of migratory waterfowl and our waterfowling heritage in Minnesota. Marsh Lake is a high priority within one of the key focus areas in western Minnesota.

We are encouraged by the progress made to-date by the planning team and we remain optimistic that a viable and cost-effective solution can be identified and agreed upon by all the parties involved. Securing federal funding in fiscal year 2009 will be critical to completing the planning phase and allow for the project to continue moving forward in a time-sensitive manner.

Please feel free to contact me if you should need additional support from Ducks Unlimited.

Sincerely,

Ryan Heiniger
Director of Conservation Programs – Minnesota/Iowa
Ducks Unlimited, Inc.

Cc: Senator Coleman, Senator Klobuchar, Congressman Peterson
Mark Holsten, Commissioner – MN DNR

Public Comments Received During Public Review Period

Comments and Responses
Several comments were received from the general public during the public review process. Each was generally supportive of the project and the overall Feasibility Study Report. These comments include:

1. June 2, 2011 letter from Jay and Tracy Ronning
2. June 15, 2011 letter from Scott Sparlin, Coalition for a Clean Minnesota River
3. June 17, 2011 letter from Brent Ronning
4. June 24, 2011 letter from Ryan Heiniger, Ducks Unlimited

Response:
USACE appreciates the support of its ecosystem restoration mission and the Marsh Lake Ecosystem Restoration Project Feasibility Study.

From: JAY & TRACY RONNING [jayandtracyr@embarqmail.com]
Sent: Thursday, June 02, 2011 9:29 AM
To: Wyatt, Michael MVP
Subject: Marsh Lake Project

Mr. Wyatt,

I just learned of the public input meeting that was to be held on 5/26/2011. Obviously, a little too late. I am disapointed in the commuication of this meeting. I did not see any notice anywhere including the Outdoor News or Appleton Press. I was wondering if I could get meeting notes or a summary of what was discussed/decided at the meeting.

I grew up in Appleton and still have family living there. I would be in favor of the plan that has been proposed. Periodic draw downs of upper Marsh Lake could be a wonderful thing for both fish and waterfowl. There is a lot of untapped potential for improvement of habitat on the lake.

If you have any kind of mailing list for communication on the project, I would like to be included.

Thank you for your work on the project.

Jayson Ronning

9124 Prestwick Court North

Brooklyn Park, MN 55443

763 315 1088

From: Scott Sparlin
To: Wyatt, Michael MVP
Subject: Written comments on Marsh Lake Project
Date: Wednesday, June 15, 2011 3:00:21 PM

Subject: Written comments on Marsh Lake Project
To: Michael.d.wyatt@usace.army.mil

These comments are for the public record on behalf of the Coalition for a Clean Minnesota River (CCMR). CCMR is a basin-wide 501 c 3 non-profit organization working to clean up pollution while improving fish and natural habitats in the Minnesota River Basin.

The Coalition for a Clean Minnesota River believes this project has been in the talking stages far too long and that implementation can not come too soon. The approximately 10 million dollar price tag associated with the project is extremely small in comparison to the public benefits that clean water, fish and wildlife improvements will have on our state, country and the entire river system including the Gulf of Mexico. On site users from all over the region will get additional access improvements for all to enjoy which also includes those with physical challenges. We have a concern about fisheries and wildlife staff working together to achieve increases in populations of forage fish and wildife which originate in Marsh Lake. A major point of that will be during draw down years when it will be critical to allow for ample time for those forage fish and wildlife to escape into Lac Qui Parle and the entire Minnesota River system. The flexibility in the draft plan to allow for climatic and environmental conditions to dictate draw down management strategies is a positive action. With the focus being on fish and wildlife Marsh Lake can be allowed to return to its former glory as a phenomenal fish and waterfoul creation body of water not to mention a natural filtration basin for water qualtiy.

Most Sincerely, Delbert Wehrspann, Director CCMR

Fwd Marsh Lake Restoration.txt

From: brandhr [brandhr1@msn.com]
Sent: Friday, June 17, 2011 8:44 PM
To: Wyatt, Michael MVP
Subject: Fwd: Marsh Lake Restoration

Begin forwarded message:

From: brandhr <brandhr1@msn.com>
Date: June 17, 2011 8:41:44 PM CDT
To: "michael.d.wyatt@suace.army.mil" <michael.d.wyatt@suace.army.mil>
Subject: Marsh Lake Restoration

Michael,

I fully support all efforts to restore the Marsh Lake ecosystem.

Brent Ronning

Sent from my iPhone

DUCKS UNLIMITED

Ryan Heiniger
Director of Conservation Programs

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24 June 2011

Michael Wyatt
U.S. Army Corps of Engineers, PD-F
180 East Fifth Street, Suite 700
St. Paul, MN 55101-1678

Dear Mr. Wyatt:

On behalf of nearly 40,000 Ducks Unlimited members and supporters in Minnesota, I am writing to provide comments and express our strong support for efforts by the U.S. Army Corps of Engineers to improve Marsh Lake in Swift and Lac Qui Parle Counties near Appleton, Minnesota. Specifically, I am providing comments in response to the St. Paul District – U.S. Army Corps of Engineers "Marsh Lake Ecosystem Restoration Feasibility Study" for the Lac Qui Parle Wildlife Management Area, Minnesota.

Improvement of water level management capabilities for Marsh Lake through the renovation of the Marsh Lake dam structure and restoration of the original Pomme de Terre River Channel is critically needed to allow for temporary water level manipulations and other active habitat management actions that will restore the lake's aquatic ecology and improve water quality for both waterfowl and humans alike. Ducks Unlimited has been actively involved in helping the Minnesota Department of Natural Resources (DNR) and U.S. Army Corps of Engineers develop ideas to Marsh Lake since we began conservation work in Minnesota in the late 1980s, and we have been specifically supporting the need to renovate the Marsh Lake Dam to include variable water level control since shortly after the dam structure was damaged in spring 1997.

Waterfowl have endured many challenges in Minnesota as prairies were plowed and wetlands drained. Today, shallow lakes are the cornerstones of the remaining waterfowl habitat throughout southern and western Minnesota. However, these unique wetland resources are not isolated from threats that jeopardize their productivity for waterfowl. Altered hydrology and invasive fish, among factors, now limit the ability of many shallow lakes to provide quality habitat for waterfowl and other wildlife, and for human recreation. Marsh Lake is no exception.

Marsh Lake is a 5,000-acre shallow lake with an average depth of only a few feet, and a long history of heavy waterfowl use during both spring and fall. It also has a history of heavy use by recreational waterfowl hunters, especially in the years immediately following dam construction when the lake was in prime condition. However, as with many shallow lakes in Minnesota, the waterfowl habitat and water quality in Marsh Lake has become degraded in recent years due to high, stable water levels, increased inflows of water and nutrients, and high numbers of invasive fish such as common carp that have failed to significantly winterkill in decades.

One of the keys to improving and maintaining the quality of shallow lakes is the legal and physical ability to manage water levels and conduct period draw-downs. Just as fire maintains the health of prairies, we know through science that shallow lakes and wetlands require periods of low water or droughts to stay healthy and productive for wildlife. This temporal variation in water levels serves to consolidate soils, winterkill invasive fish, and allow aquatic plants to germinate and expand. Once reflooded, aquatic plants stabilize wetland bottom substrates during wind events, absorb and store nutrients, and provide important wetland wildlife habitat.

The Marsh Lake Ecosystem Restoration Feasibility Study for the Lac Qui Parle Wildlife Management Area in Minnesota does an excellent job of addressing the main drivers of poor water quality and turbidity in Marsh Lake. Primarily, these include the lack of variable water level control in Marsh Lake Dam, the alteration of the Pomme de Terre River that currently discharges into Marsh Lake directly instead of through its original channel into the Minnesota River below, and the corresponding lack of natural fish winterkill events that result. The high, stable water levels resulting from the fixed crest dam combined with constant water inflow from the Pomme de Terre River has allowed invasive common carp numbers in the lake to explode and dominate the ecology of the system. Thus, improving Marsh Lake will require the dam be modified to include a draw-down structure (and the structure be subsequently be actively managed), and the Pomme de Terre River be restored to it's natural channel that enters the Minnesota River downstream of the Marsh Lake dam.

The Study does a good job of laying out the alternatives and identifying the most cost-effective, critical elements to pursue with federal and state funding. Ducks Unlimited supports both Alternative Plan 3 and Alternative Plan 4 that calls for restoration of the Pomme de Terre River and the inclusion of a draw-down structure. Both Alternative Plans also include gated structures for the Louisburg Grade Road culverts, which if managed properly, could also be useful to enhanced water level management in the Marsh Lake system. Alternative Plan 4 also includes modifications of Marsh Lake Dam to include a fish way, which is forecasted to improve native fish passage into Marsh Lake and help balance the fishery to a more native state. If that indeed happens, then that aspect of the project will be beneficial too. However, given the abundance of carp in the system, we remain concerned that providing fish passage will also provide passage of carp and other invasive fish species, potentially negating the benefits from Pomme de Terre River restoration and periodic draw-downs of Marsh Lake.

Therefore, we highly recommend that if the Marsh Lake Dam is modified to allow fish passage into Marsh Lake from the Minnesota River below via Alternative Plan 4, state and federal fisheries specialists should closely monitor fish movements into Marsh Lake and fish populations that result, and plans made to modify the fish passage structure should additional invasive species be found to be problematic.

As noted above, we strongly endorse the use of periodic draw-downs to enhance Marsh Lake and associated wetlands, and the construction of both a draw-down feature in the Marsh Lake Dam and the construction of gated structures on Louisburg Grade Road culverts will provide state and federal wildlife managers with the ability to actively manage water levels in both Marsh Lake and the West Pool. However, it will then be critical that state and federal agencies agree on an active water level management plan for the system, and follow through with the implementation of periodic, temporary water level draw-downs to improve the system. Because it tends to be human nature to avoid change and because some stakeholders will not appreciate the lower water levels in Marsh Lake, albeit even temporarily, there may be significant pressures to delay or not implement water level draw-downs after project completion. That would simply be unacceptable, and we urge advance planning among the Corps, Minnesota DNR, and stakeholders to reach agreement on future management actions to ensure future improvement of the overall system.

Ducks Unlimited looks forward to being part of these ongoing discussions and to helping the Corps and DNR seek federal and state funding to implement this important shallow lake improvement project.

Sincerely,

Ryan Heiniger

Ryan Heiniger
Director of Conservation Programs – Minnesota, Iowa, Nebraska, Colorado, & Wyoming

CC: Senator Amy Klobuchar
Senator Al Franken
Congressman Collin Peterson
Tom Landwehr, Minnesota DNR Commissioner
Dennis Simon, Minnesota DNR Chief of Wildlife
David Trauba, Minnesota DNR Area Wildlife Manager – Lac Qui Parle WMA
Jon Schneider, DU Manager – Minnesota Conservation Programs
Josh Kavanagh, DU Biologist - Minnesota

Agency Comments Received During Public Review Period

Two comment letters were received from State and Federal Agencies:

1. June 24, 2011 letter from Minnesota Pollution Control Agency (MPCA)
2. June 24, 2011 letter from the Environmental Protection Agency (EPA)

Response to MPCA Comments:

- General Comment
  Based on the responses included below, USACE is seeking concurrence that the Environmental Assessment is complete and that Section 401 Water Quality Certification will be issued following the development, submittal and concurrence of information completed during design phase. Section 10.3 has been updated to identify future permits required for construction from the Minnesota Pollution Control Agency.
- Section 4.1.4
  Efforts have been made to select the environmentally least impactful and cost-effective plan for restoration of ecosystem features in and around Marsh Lake. As noted in Section 4.1.4, there is approximately 0.5-feet of fine sediment covering the historic river channel of its approximate two-mile length. Rerouting of the river is estimated to discharge approximately 1425 cubic yards of sediment into Lac qui Parle. Mechanical removal of sediment from the historic Pomme de Terre River channel would result in impacts to environmentally sensitive areas during construction which is inconsistent with the plan formulation. As proposed the net sediment loads to the Lac qui Parle reservoir will not change as a result of the project, however, the entire sediment load to the upper pool of Marsh Lake originating from the Pomme de Terre River will be eliminated. The intent of this effort is to reduce the sediment loading and ultimately reduce turbidity within Marsh Lake.
- Section 4.1.6
  There is currently no plan to physically remove fish from the lake. Following construction, the project features will be operated by the State of Minnesota, the non-Federal sponsor. The State, at its expense, may choose to voluntarily remove fish killed as a result of winter drawdowns. No removal is currently performed for seasonal fish-kills at the site. Section 6.7.12 has been updated to clarify the potential impact on biological productivity.
- Section 6.7
  - Bullet 1
    Construction contractors will be directed to apply for NPDES Permits; Section 10.3 has been updated to clarify the need for future permits.
  - Bullet 2
    Construction contractors will be directed to apply for NPDES Permits and include the acreage of recreation facilities within the area calculation necessary for the permit. Section 10.3 has been updated to clarify the need for future permits.

- Bullet 3
  Best Management Practices will be incorporated into the final design of the project. Section 6.7.13 of the feasibility study and environmental assessment has been amended to include the acknowledgement of the potential for temporary impacts resulting from construction activities and the need for erosion control on site during construction.
- Bullet 4
  Best Management Practices will be incorporated into the final design of the project. Section 6.7.13 of the feasibility study and environmental assessment has been amended to include the acknowledgement of the potential for temporary impacts resulting from construction activities and the need for erosion control on site during construction.
- Bullet 5
  Efforts have been made to select the environmentally least impactful and cost-effective plan for restoration of ecosystem features in and around Marsh Lake. As noted in Section 4.1.4, there is approximately 0.5-feet of fine sediment covering the historic river channel of its approximate two-mile length. Rerouting of the river is estimated to discharge approximately 1425 cubic yards of sediment into Lac qui Parle. Mechanical removal of sediment from the historic Pomme de Terre River channel would result in impacts to environmentally sensitive areas during construction which is inconsistent with the plan formulation. As proposed the net sediment loads to the Lac qui Parle reservoir will not change as a result of the project, however, the entire sediment load to the upper pool of Marsh Lake originating from the Pomme de Terre River will be eliminated. The intent of this effort is to reduce the sediment loading and ultimately reduce turbidity within Marsh Lake.

- Miscellaneous Comments
  Thank you for your attention to detail. Changes and edits will be made as necessary.

Response to EPA Comments:

- **General Comment**
  USACE appreciates the support of its ecosystem restoration mission and watershed study efforts.
- **Mussels**
  Section 4.1 details options for potential relocation of mussels by the non-Federal sponsor. A decision on relocation will be made based on interest and available resources of Minnesota Department of Natural Resources.

Minnesota Pollution Control Agency
520 Lafayette Road North | St. Paul, Minnesota 55155-4194 | 651-296-6300
800-657-3864 | 651-282-5332 TTY | www.pca.state.mn.us | Equal Opportunity Employer

June 24, 2011

Mr. Michael Wyatt
Project Manager
St. Paul District, US Army Corps of Engineers PD-F
180 5th Street East, Suite 700
St. Paul, MN 55101-1678

Re: Marsh Lake Ecosystem Restoration Project Draft Environmental Assessment

Dear Mr. Wyatt:

Thank you for the opportunity to review and comment on the Draft Environmental Assessment (EA) for the Marsh Lake Ecosystem Restoration project (Project) located in Lac Qui Parle, Swift, and Big Stone Counties, Minnesota. The Project consists of restoration of the degraded Marsh Lake ecosystem. Regarding matters for which the Minnesota Pollution Control Agency (MPCA) has regulatory responsibility and other interests, MPCA staff has the following comments for your consideration.

General Comment

The Draft EA lacks an evaluation of the environmental impact of the construction efforts proposed and also lacks an acknowledgement and description of the regulatory/permit requirements for the Project. The document should describe the regulatory requirements and mitigation that would likely be required to construct the various components of the selected alternative. As the Project is further developed, the MPCA will need the details on how the Project will be carried out in order to issue any approvals and permits within its jurisdiction.

Request for Timely Section 401 Water Quality Certification Determination

By letter to the MPCA, dated May 11, 2011, the U.S. Army Corps of Engineers (USACE) requests a timely Clean Water Act Section 401 Water Quality Certification (401 Certification) determination from the MPCA for this Project. The MPCA concludes there is insufficient information within the Draft EA to demonstrate that the proposed Project can reasonably be anticipated to comply with the applicable water quality standards, which is what a favorable 401 Certification determination would indicate. There are two general options available for handling requests for timely 401 Certifications that do not contain sufficient information for the MPCA to make an informed determination:

(A) The MPCA can provide a formal Denial Without Prejudice on the request for the 401 Certification, which would allow the USACE to reapply for a 401 Certification after it can responsibly demonstrate how the Project will be able to comply with the applicable water quality standards (i.e., after plans and specifications have been prepared and site-specific, appropriate mitigative measures and best management practices (BMPs) are proposed); or

(B) The USACE can formally withdraw its request for the 401 Certification (e-mail correspondence would suffice) and reapply for it after plans and specifications are prepared and site-specific, appropriate mitigative measures and BMPs are proposed.

Mr. Michael Wyatt
Page 2
June 24, 2011

Please decide which of these two options the USACE would like to pursue, and notify the MPCA accordingly within 30 days of the date of this correspondence. For questions or information about the 401 Water Quality Certification process, please contact Kevin Molloy at 651-757-2577.

Section 4.1.4
The MPCA would prefer mechanical removal of the sediment in the natural channel, prior to restoration of flow in that channel, instead of the sediment being flushed into Lac Qui Parle. That sediment should also be tested to determine whether any contaminants of concern are present.

Section 4.1.6
There was no mention of what would be done with the carp killed through the use of a winter drawdown (page 127). The MPCA is concerned that, if not removed, the dead carp would contribute to the biological oxygen demand loading in the water body as they decompose.

Section 6.7

- The document did not list the permits/approvals (other than the 404(B)(1) evaluation and the mention of the need for a MPCA 401 certification) that would be required to implement the proposed Project and did not identify the impacted area measurements of the construction activity to determine if it would meet the threshold of the permits/approvals. Specifically, the MPCA National Pollutant Discharge Elimination System/State Disposal System (NPDES/SDS) Construction Stormwater Permit (CSW Permit) must be one of the permits discussed in the Final EA.

- Construction of the recreation facilities should be considered part of the ecosystem restoration project such that the acreage of land disturbing activities is included in the acreage of disturbance for the ecosystem restoration project and coverage under the CSW Permit is obtained to cover both activities if the combined total of disturbance is over one acre.

- The Final EA must identify potential BMPs that would be incorporated into the construction both in the upland areas and for the in water work in order to protect downstream water quality.

- The Final EA should identify and describe the additional (CSW Permit Appendix A) BMP efforts that must be undertaken to protect the Pomme de Terre River required because of its MPCA impaired waters listing status. In addition, the document should identify and discuss required BMPs if the Project activity will trigger requirements for permanent stormwater runoff treatment BMPs. See the CSW Permit for these requirements at the MPCA website: http://www.pca.state.mn.us/wfhya5b.

- The Draft EA indicated in 6.7.3. that as part of the construction proposal to restore the Pomme de Terre River channel, the old channel would not be dredged or otherwise modified so no disposal area would be needed. The document stated that the flow of the river would be allowed to scour accumulated sediment and debris from the old channel. This proposal to let the river scour the sediments in the old channel downstream in the impaired Pomme de Terre River and then to the Minnesota River must be evaluated regarding the potential impacts of this sediment redistribution downstream. If the conclusion is that it would adversely affect the downstream water quality, the document must evaluate alternatives (such as dredging) to avoid this type of in water sediment release as part of the channel restoration.

Miscellaneous Comments

- The MPCA believes that there is an error on page 102, just above section 3.3 in that there is reference to a dam on the Pomme de Terre 56 miles upstream of Marsh Lake at Marshall, Minnesota. The MPCA suspects that should be Morris, Minnesota.

- There is an error in the date of the Pool 8 drawdown on Figure 4-6, on page 124. Pool 8 of the Mississippi River was drawn down in 2000 and 2001.

- Table 5-1 on page 141 was missing and there was no placeholder listed on that page.

- Earlier in the document, the MPCA was named as having participated in Project discussions; however, the area (e.g., water quality, etc.) was not mentioned. Also, the MPCA was not listed in section 10.3 State Agencies on pages 201 – 202, nor listed with Other Partners on page 211. Please state who at the MPCA was involved in the discussions.

We appreciate the opportunity to review this Project. We look forward to seeing these comments adequately addressed in the Final EA. Please be aware that this letter does not constitute approval by the MPCA of any or all elements of the Project for the purpose of pending or future permit action(s) by the MPCA. Ultimately, it is the responsibility of the Project proposer to secure any required permits and to comply with any requisite permit conditions. If you have any questions concerning our review of this Draft EA, please contact me at 651-757-2508.

Sincerely,

Karen Kromar

Karen Kromar
Planner Principal
Environmental Review and Feedlot Section
Regional Division

KK:mbo

cc: Craig Affeldt, MPCA, St. Paul
Larry Zdon, MPCA, St. Paul
Judy Mader, MPCA, St. Paul
Kevin Molloy, MPCA, St. Paul
Doug Wetzstein, MPCA, St. Paul

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

JUN 1 7 2011

REPLY TO THE ATTENTION OF:

E-19J

Michael Wyatt, Project Manager
St. Paul District, U.S. Army Corps of Engineers, PD-F
180 Fifth Street East, Suite 700
St. Paul, Minnesota 55101-1678

Re: Draft Marsh Lake Ecosystem Restoration Project Feasibility Report, Environmental Assessment and Draft Finding of No Significant Impact

Dear Mr. Birkenstock:

The U.S. Environmental Protect Agency has reviewed the above-mentioned document in accordance with our responsibilities under the National Environmental Policy Act, the Council on Environmental Quality's NEPA Implementing Regulations (40 CFR 1500-1508), and Section 309 of the Clean Air Act.

The geographic area for the Marsh Lake project includes Marsh Lake, the Pomme de Terre River outlet, the Marsh Lake Dam, and the upper portion of the Lac qui Parle reservoir. The stated purpose of the proposed project is to restore the aquatic and riparian ecosystems in the Marsh Lake project area. EPA has only one comment to offer pertaining to the Tentatively Selected Plan.

The lower Pomme de Terre River supports a diverse mussel community with two state-listed mussel species – elktoe and black sandshell. Mussels in the lower reach of the channelized Pomme de Terre River below the lower cut-off dike would no longer be located in a flowing river and would likely die following restoration activities. Likewise, mussels currently found in the locations of the proposed cut-off dikes would be buried. As these mussel species are not federally-listed species, there is no federal interest in a large-scale mussel relocation effort. The Minnesota Department of Natural Resources (MnDNR) is planning to monitor the recolonization of the restored river channel as part of the project. We encourage MnDNR to harvest mussels from the impact areas and temporarily relocate and stock them into the restored river channel. This effort is appropriate, given the low population numbers of most mussel species, and the relatively low cost of this effort in light of the overall project cost. It would dovetail with MnDNR's plan to monitor recolonization of the restored river channel.

EPA commends the Army Corps of Engineers (ACE) and MnDNR for addressing the need for ecosystem restoration in the study area. We acknowledge that problems in the Marsh Lake ecosystem are symptoms of larger watershed issues (i.e., high sediment and nutrient loading). As stated in the EA, the ongoing Minnesota River Basin Watershed, Water Quality and Ecosystem Restoration Study is designed to explore possible alternatives for watershed improvement, water quality management, and ecosystem restoration throughout the Minnesota River Basin. We realize potential solutions for watershed improvement may be outside of ACE's authority. Nevertheless, a comprehensive study outlining the full array of problems plaguing the basin and possible solutions creates opportunities for unique partnerships to develop and address basin-wide problems.

Lastly, we commend ACE for including potential climate change-related impacts into the analysis.

We appreciate the opportunity to comment on this project. If you have any questions regarding the contents of this letter, please do not hesitate to contact me or Kathleen Kowal of my staff at (312) 353-5206 or via email at kowal.kathleen@epa.gov.

Sincerely,

Kenneth A. Westlake, Chief
NEPA Implementation Section
Office of Enforcement and Compliance Assurance

Appendix P – Sediment Resuspension/Aquatic Plant Growth

Modeling the Effects of Fetch Reduction on the Potential for Persistence of Sago Pondweed in Marsh Lake, Minnesota River System

2 April, 2010

William F. James
ERDC Eau Galle Aquatic Ecology Laboratory
W. 500 Eau Galle Dam Road
Spring Valley, Wisconsin 54767

Objectives:

The objectives of this research were to explore the potential for improving underwater light climate in shallow Marsh Lake (Minnesota) to promote growth and reproduction of Sago Pondweed for waterfowl habitat. An empirical sediment resuspension model was used to evaluate the effects of island establishment on reduction in fetch and wind-generated sediment resuspension, and improvement in light attenuation. A submersed macrophyte growth model (SAGO) was used to evaluate the potential for growth and persistence of Sago Pondweed under current and future conditions.

Methods:

The critical bottom shear stress (τ_c) of sediments in Marsh Lake was determined experimentally using a particle entrainment simulator (PES) designed exactly as described by Tsai & Lick (1986). The PES consisted of a vertically-oscillating, perforated acrylic grid that was driven by a computer-controlled motor. The grid was positioned so that the bottom of its oscillation cycle occurred exactly 5.08 cm (2 inches) above the interface of an intact sediment core. A cam on the motor shaft allowed the grid to oscillate up and down for a distance of 2.54 cm (1 inch).

Intact sediment cores, 10 cm in depth, were collected using a 15 by 15 cm box corer (Wildco Wildlife Supply Company, Saginaw, Michigan) for determination of τ_c. The sediment contained in the box corer was transferred to a 13 cm (5 inch) diameter by 20 cm acrylic cylinder by carefully slipping the cylinder over the sediment enclosed by the box core sleeve and sliding a thin plexiglass disk underneath the cylinder to contain the sediment. The sediment cores were stored in cushioned coolers filled with water and transported to the laboratory via vehicle with water overlying the sediment to minimize changes in physical characteristics (moisture content and density) that would have occurred due to desiccation. In the laboratory, the overlying water was removed and 1.36

L (to a height of 5 inches) of local tap water was then carefully siphoned onto the sediment surface of the sediment core system.

To determine τ_c, the motor of the PES was programmed to oscillate above the sediment interface in a stepwise manner from 0 to 800 revolutions per minute (RPM) at 100 RPM increments every 10-min intervals. At 8 min into each RPM cycle, a 50 mL sample was collected 2.54 cm below the water surface using a peristaltic pump. Water removed as a result of sampling was simultaneously replaced with filtered lake water using a peristaltic pump. Samples were analyzed for TSS and turbidity. Values were corrected for dilution effects by replacement water. RPM was converted to τ using the calibration curve developed by Tsai & Lick (1986; Fig. 5, page 317) for levels ranging between 430 and 750 RPM. I used linear interpolation to estimate τ for levels that occurred below 450 RPM and above 750 RPM. Thus, τ ranged from 0 to nearly 6 dynes cm^{-2}. The τ_c was estimated as the inflection point where TSS and turbidity increased in the water column above background conditions. Sediment collected at historical station 1 (James and Barko 1994) was used to determine τ_c. Sediment resuspension was predicted to occur at this station when calculated bottom τ exceeded τ_c.

The theoretical bottom τ was calculated as:

$$\tau = H\left[\frac{\rho\left(\upsilon(2\pi / T)^3\right)^{0.5}}{2\sinh(2kh)}\right]$$

where τ is the calculated bottom shear stress, H is the wave height (cm), ρ is the density of water (1 g cm^{-3}), T is the wave period (s), v is the kinematic viscosity, k is the wave number (2π/L where L = wave length, cm), and h is the water depth (cm). Since H, T, and L are related to effective fetch (CERC 1977), shear stress will change (i.e., decline) as a function of decreasing fetch due to island placement.

The concentration of TSS (C_{TSS}; mg L^{-1}) in the water column at station 1 was predicted using the equation (Bengtsson & Hellström, 1992; Hamilton & Mitchell, 1996; Bailey & Hamilton, 1997):

$$C_{TSS} = C_e + C_{background} + (C_i - C_e - C_{background}) \bullet \exp\left(\frac{-\omega_s}{h} t\right)$$

where C_e is the TSS equilibrium concentration when sediment resuspension balances sediment deposition, $C_{background}$ is the TSS concentration under quiescent periods, C_i is the initial TSS concentration, ω_s is the depth-averaged settling velocity (cm s^{-1}), h is the depth of the water column (cm), and t is the time step (seconds). The ω_s of particles was determined via particle size analysis (Plumb 1981). C_e was estimated from the following equation:

$$C_e = 0$$

when $\tau_c < \tau$

$$C_e = A\left(\frac{\tau - \tau_c}{\tau_{ref}}\right)^n$$

when $\tau_c > \tau$

where τ_{ref} is 1 dyne cm^{-2} (i.e., to make τ dimensionless; Luettich et al., 1990; Hamilton and Bailey 1996); and A and n are constants determined via regression analysis of resuspended TSS concentration versus excess τ. The resuspension model was calibrated against TSS information collected at station 1 in 1992 (James and Barko 1994). A summary of values used as model parameters for determination of TSS are shown in Table 1.

The model POTAM (Best and Boyd 2003a and b) was used to simulate Sago Pondweed growth and tuber production at station 1 under 1992 conditions with and without fetch reduction due to island establishment. Inputs to the model included a daily light attenuation coefficient (k_d), water depth, and water temperature. k_d was estimated from simulated TSS using the regression relationship $k_d = 0.097 \cdot TSS + 0.942$ developed for Peoria Lake, Illinois (James et al. 2004). The model was initialized using model defaults developed for northern temperate regions of the United States. The initial tuber dry mass was 0.155 g DW tuber^{-1}, the dormant tuber number density was 240 tubers m^{-2}, and the tuber number per plant was set at 8. The model was run for a 5 year period using estimated daily k_d for 1992 as input for each year. The tuber dry mass produced at the end of the growing season was used as input for the next year and so on.

Summary of Results:

Variations in turbidity versus shear stress for an intact sediment core subjected to the particle entrainment simulator are shown in Figure 1. Turbidity was low and relatively constant below 2 dynes cm^{-2}. Above a critical shear stress of 2.3 dynes cm^{-2}, turbidity increased substantially. During 1992, high TSS concentrations in the water column coincided with peaks in wind speed in May, mid-June, and September through November (Figure 2). There was generally good agreement between simulated and observed TSS. The model overpredicted TSS in May; however, observed values represented an average of a daily sample that was composited at 8-hour intervals whereas simulated results represented instantaneous values.

Variations in mean daily TSS and daily k_d and mean effective fetch before and after island establishment are shown in Figure 3. Under 1992 conditions, daily TSS and k_d were very high during period of sediment resuspension, coinciding with large fetches during periods of high winds. Simulated daily TSS and kd declined in June and early September as a result of reduced fetch after island establishment.

POTAM simulations suggested that Sago Pondweed shoot biomass and tuber production were impacted as a result of frequent resuspension and low k_d (Figure 4). Low tuber dry mass after the first year of growth resulted in low shoot and tuber biomass production during the second year. Growth and persistence was unsustainable over the 5-year period. In contrast, simulated Sago growth and tuber production were persistent under conditions of island establishment. Maximum shoot biomass, tuber dry mass density and dry mass per tuber for September are shown in Figure 5. In general, model simulations suggested that island establishment and fetch reduction resulted in improvement in underwater light condition for successful Sago growth and persistence over a five year period.

References:

Bailey, M.C., & D.P. Hamilton, 1997. Wind induced sediment resuspension: A lakewide model. Ecological Modeling 99: 217-228.

Bengtsson, L., & T. Hellström, 1992. Wind induced resuspension in a small shallow lake. Hydrobiologia 241: 163-172.

Best, E. P. H., & W.A. Boyd. 2003a. POTAM (Version 1.0): A Simulation Model for Growth of Sago Pondweed. ERDC/EL SR-03-1, U. S. Army Engineer Research and Development Center, Vicksburg, MS.

Best, E. P. H., & W.A. Boyd. 2003b. A Simulation Model for Growth of the Submersed Aquatic Macrophyte Sago Pondweed (*Potamogeton pectinatus L.*). ERDC/EL TR-03-6, U. S. Army Engineer Research and Development Center, Vicksburg, MS.

Coastal Engineering Research Center, 1984. Shore protection manual, Volume 1. U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, Mississippi, USA.

Hamilton, D.P., & S.F. Mitchell, 1996. An empirical model for sediment resuspension in shallow lakes. Hydrobiologia 317: 209-220.

James, W.F., & J.W. Barko, 1994. Macrophyte influences on sediment resuspension and export in a shallow impoundment. Lake and Reservoir Management 10:95-102.

Luettich, R.A., D.R.F. Harleman, & L. Somyódy, 1990. Dynamic behavior of suspended sediment concentration in a shallow lake perturbed by episodic wind events. Limnology and Oceanography 35: 1050-1067.

Plumb, R.H., 1981. Procedures for handling and chemical analysis of sediment and water samples. Technical Report EPA/CE-81-1. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi

Tsai, C.H., & W. Lick, 1986. A portable device for measuring sediment resuspension. Journal of Great Lakes Research 12:314-321.

Table 1. Values used as model parameters for estimating TSS in Marsh Lake.

Parameter	Value	
τ_c	2.3	dynes cm^{-2}
A	1275	
n	0.8	
ω_s	0.0005	cm s^{-1}
h	0.6	m
t	15	min
$C_{background}$	20	mg/L
$C_{initial}$	20	mg/L

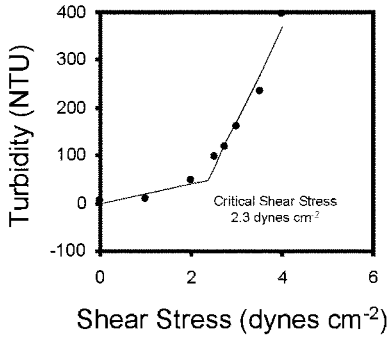

Figure 1. Variations in turbidity versus applied shear stress measured in the laboratory using a particle entrainment simulator.

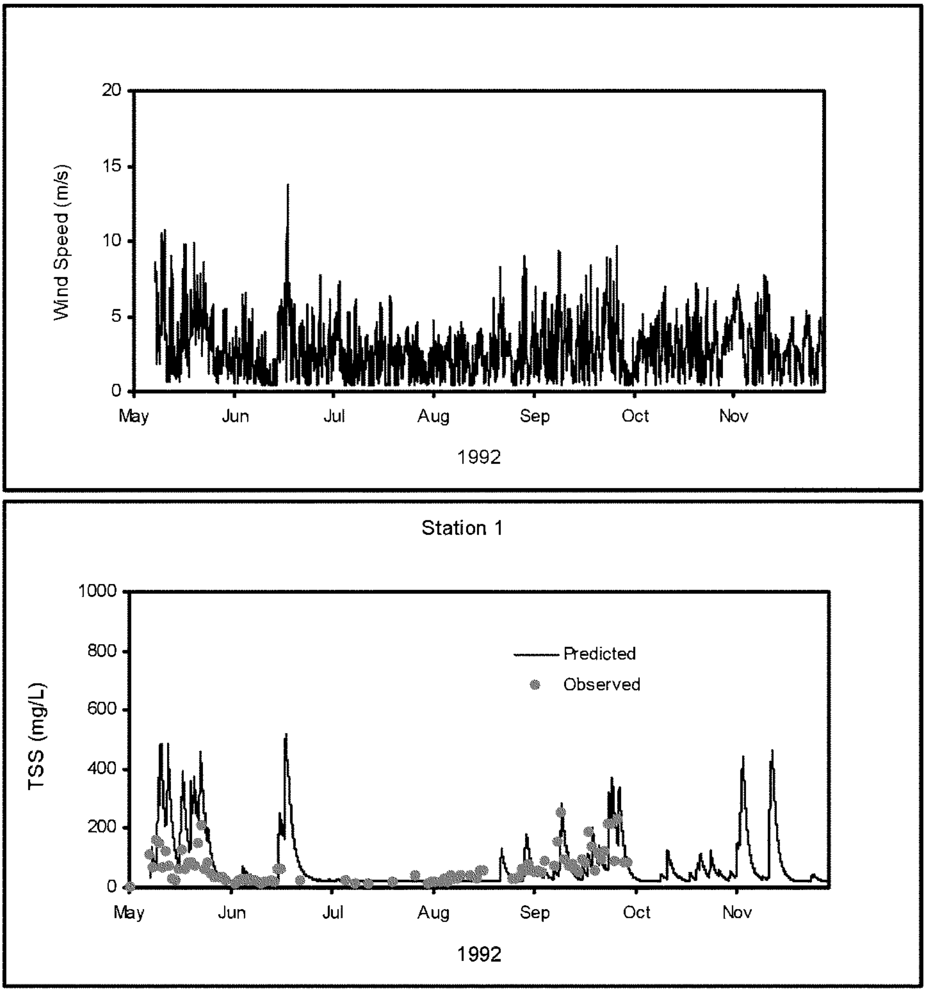

Figure 2. Seasonal Variations in wind speed (upper) and predicted versus observed total suspended sediment (TSS; lower).

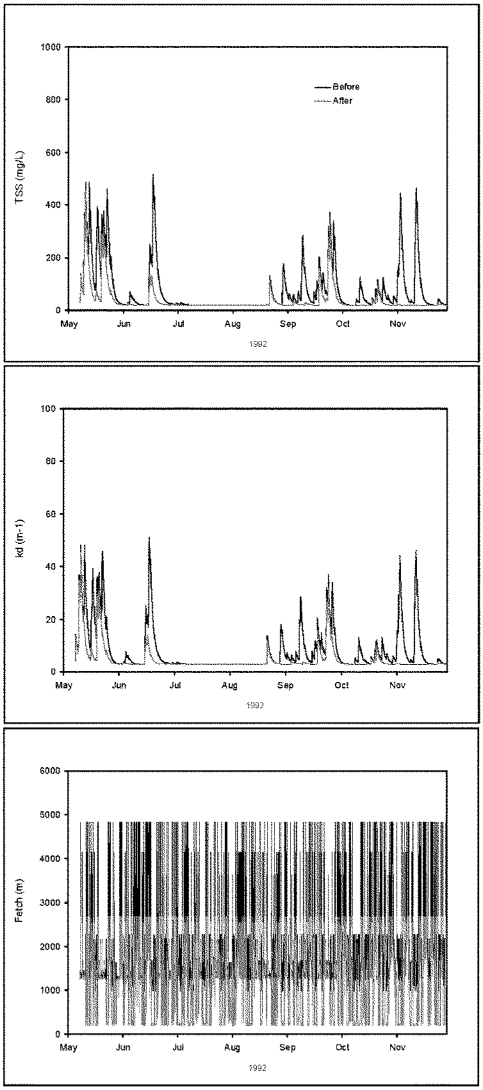

Figure 3. Seasonal variations in simulated total suspended sediment (upper), the light attenuation coefficient (middle), and effective fetch (lower) before and after island establishment in Marsh Lake.

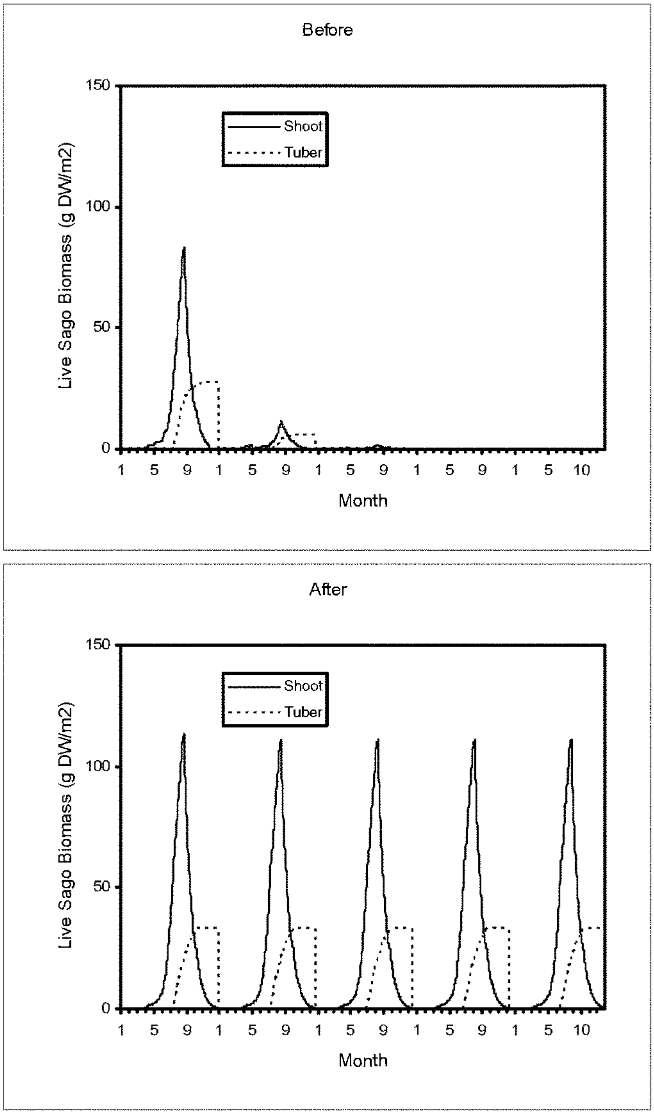

Figure 4. Variations in live sago shoot and tuber biomass over a 5 year period before (upper) and after (lower) island establishment in March Lake.

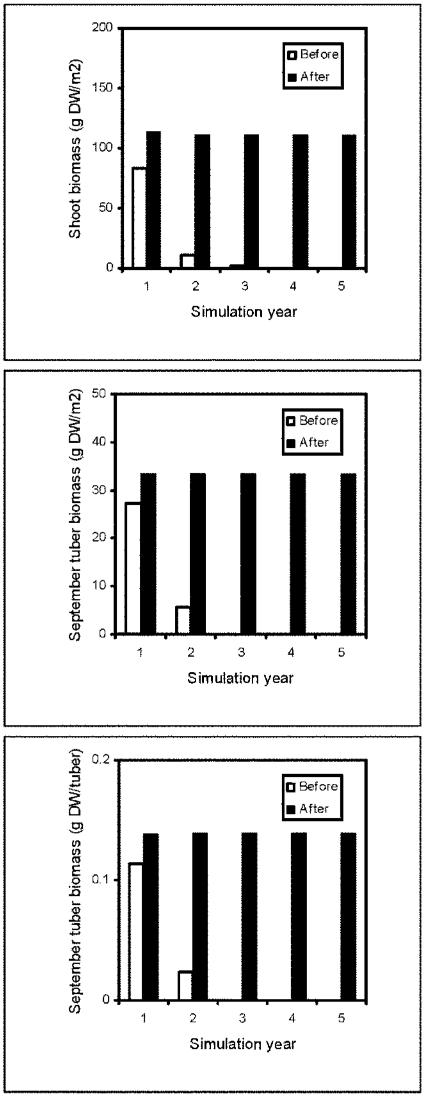

Figure 5. Variations in simulated maximum Sago shoot biomass (upper), tuber density (middle), and tuber biomass in September (lower) over a 5 year period before and after island establishment.

Appendix Q – Mussel Survey

Lower Pomme de Terre River Channel Restoration – Pre-project Mussel Surveys, 2007 and 2010

Introduction

Currently, the channelized lower Pomme de Terre River flows into Marsh Lake flowing a short distance to the overflow spillway at Marsh Lake Dam. Bed sediment has been depositing a delta in Marsh Lake, and the suspended sediment flows into the Minnesota River and on into Lac qui Parle. Rerouting the lower Pomme de Terre River to its former channel and floodplain at the confluence with the Minnesota River downstream of Marsh Lake Dam (Figure 1) would restore natural floodplain processes. Sediment would be deposited overbank in the floodplain during higher discharge events. The Pomme de Terre River would be re-routed into its former channel in a meander loop upstream of Marsh Lake Dam and into the longer former channel downstream of the Marsh Lake Dam by constructing earthen cut-off dikes (Figure 1).

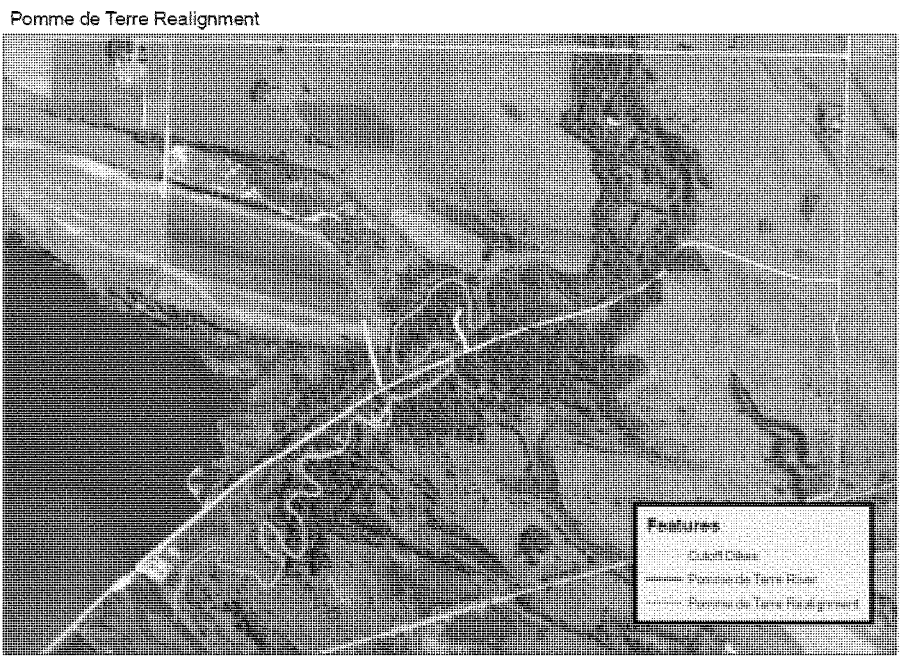

Figure 1. Lower Pomme de Terre River showing the current channelized reach cutoff dikes and proposed realignment with the historic channel.

The lower Pomme de Terre River supports an abundant and diverse mussel community. Mussels in the lower reach of the channelized Pomme de Terre River below the lower cut-off dike would no longer be in a flowing river and would probably die eventually. Mussels in the locations of the cut-off dikes would be buried. Mussels are expected to recolonize the reconnected segments of the old channel over time. Mussel surveys were designed to allow for monitoring the impact to mussels in the proposed cut off areas, the ongoing status of mussels in a reference area upstream of the channel realignments, and colonization of the reconnected channel segments that presently do not support mussels.

<u>Methods – timed searches</u>

In 2007 and 2010, timed searches for mussels were done at five sites within the area of channel to be cutoff during the project and five within a reference reach upstream of the proposed channel realignment (Figure 2).

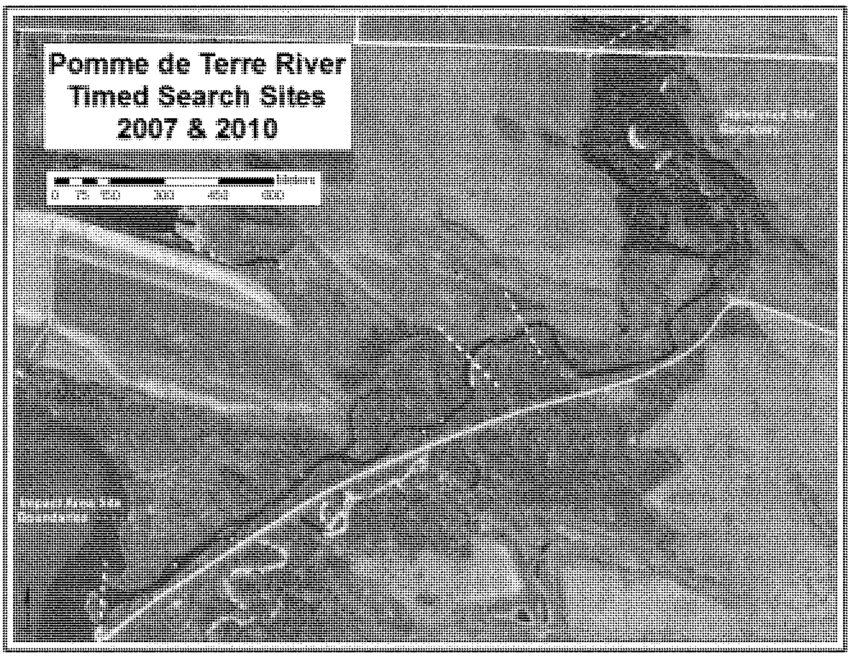

Figure 2. Timed search sample sites in the lower Pomme de Terre River.

Timed searches were conducted by wading, snorkeling or SCUBA diving. In turbid water like we encountered in the Pomme de Terre, searching is mostly by feel with the searcher sweeping the bottom surface and digging into the substrate a few centimeters to find mussels. After a period of time, usually 20-30 minutes for each person searching, all live mussels and empty shells collected are brought to shore and sorted and enumerated by species. Catch Per Unit Effort (CPUE) is calculated for each site by dividing the number of live mussels collected by the time spent searching. Each species is then sorted into two age categories; ≤5 years and >5 years. For each species collected the minimum and maximum lengths represented in each age category is recorded. Species collected only as empty shells were recorded as fresh dead, weathered dead, or in sub-fossil condition. All live mussels were returned to the river by scattering them within the collection area.

Methods – quantitative sampling

We used a systematic sampling approach with a random start for quantitative sampling. Systematic sample sites form a grid pattern that eliminates the potential for odd clustered groups of sample sites that are common with simple random sampling plans (Cochran 1977). When establishing a grid using ArcMap software it often will include sample sites that are not actually in the target area (a meandered river channel), these are eliminated from actual sampling as needed during the field work. Figure 3 shows the quantitative sampling sites on the Pomme de Terre River.

Samples are collected using a ¼ m^2 aluminum frame with a 6.35 mm square mesh bag attached. Each quadrat sample site is located by navigating with a GPS unit programmed with the systematic grid of sites to be sampled. Upon reaching the coordinates of a site the sample frame is dropped to the bottom and the material within the frame is scooped into the attached bag, excavation within the frame is to a depth of approximately 15 cm. When the excavation of bottom material is complete the frame and bag are rinsed in the water to remove material smaller than 6.35mm. Any remaining material is placed on a sorting platform where any mussels or shells are removed, species identified, aged by counting growth arrest rings (assumed to be annual), and total length recorded to the nearest millimeter using a caliper. Samples collected in this way are assumed to be free of the bias that samples collected by sight or touch would introduce, sometimes producing different results in terms of species relative abundance (small species may be under sampled when search methods depend on the collectors skills and experience) or size distributions within a species' population.

Data was collected from 97 quadrat samples within the impact area and 141 samples within the reference area (Figure 3). To estimate the surface area of the river in each area a polygon was created by tracing the shoreline in 2009 aerial photo using ArcMap to calculate the area in square meters.

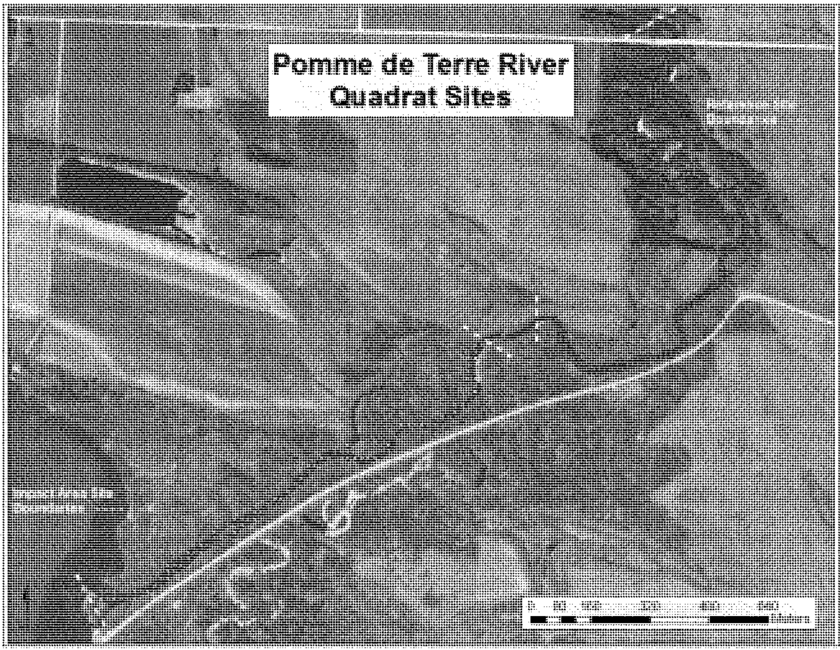

Figure 3. Quantitative sample sites in the lower Pomme de Terre River.

Results – timed searches

Timed searches in the impact area produced 1,457 live mussels representing 11 species (Table 1), including *Ligumia recta* (black sandshell) a species of Special Concern in Minnesota that was collected at all 10 timed search sites. *Amblema plicata* (threeridge) was the species collected in greatest abundance. CPUE in the impact area ranged from a low of 0.8 mussels/minute to a high of 6.12 mussels/minute (Figure 4.).

Impact area

Species	**Number**

	Found Live
Threeridge	
Amblema plicata	938
Plain Pocketbook	
Lampsilis cardium	162
Deertoe	
Truncilla truncata	117
Fat Mucket	
Lampsilis siliquoidea	96
Pigtoe	
Fusconaia flava	51
Black Sandshell	
Ligumia recta	33
Pink Heelsplitter	
Potamilus alatus	21
White Heelsplitter	
Lasmigona complanata	18
Fragile Papershell	
Leptodea fragilis	16
Giant Floater	
Pyganodon grandis	3
Creeper	
Strophitus undulatus	2
Grand Total	**1,457**

Table 1. Relative abundance of mussel species collected during timed searches in the Lower Pomme de Terrre impact area.

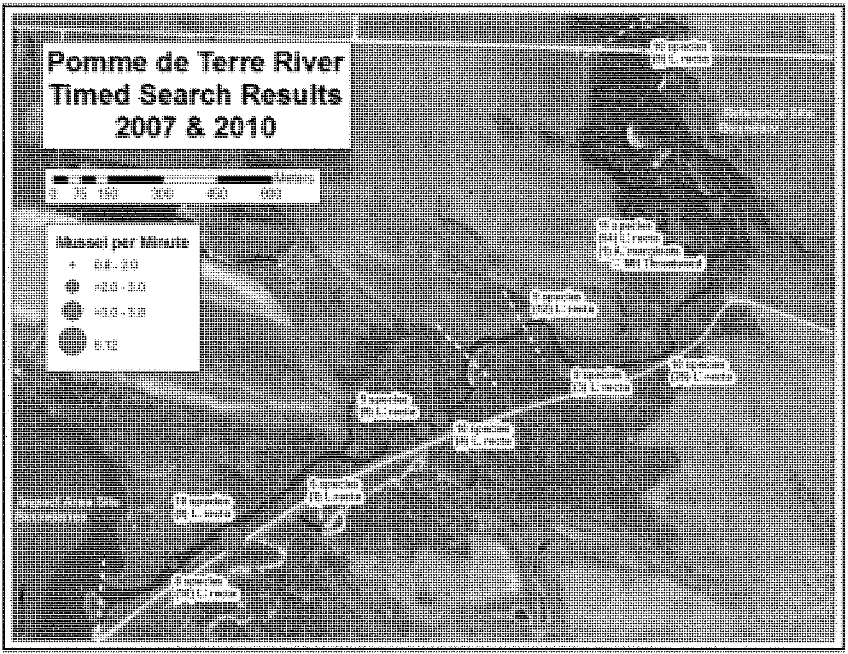

Figure 4. Timed search results in the Pomme de Terre River.

Timed searches in the reference area produced a total of 1,037 live mussels representing 11 species including *Alasmidonta marginata* (elktoe) a state Threatened species and *Ligumia recta* (black sandshell) a state species of Special Concern (Table 2).

Reference Area

Species	Number Found Live
Plain Pocketbook	
Lampsilis cardium	412
Threeridge	
Amblema plicata	285
Black Sandshell	
Ligumia recta	106
Fat Mucket	
Lampsilis siliquoidea	88
Pigtoe	
Fusconaia flava	46

Deertoe	
Truncilla truncata	45
Pink Heelsplitter	
Potamilus alatus	20
Creeper	
Strophitus undulatus	13
Fragile Papershell	
Leptodea fragilis	13
White Heelsplitter	
Lasmigona complanata	8
Elktoe	
Alasmidonta marginata	1
Grand Total	**1037**

Table 2. Timed search results in the reference area, lower Pomme de Terre River.

CPUE at sites within the reference area were lower with a maximum of 3.76 mussels/minute (Figure 4).

Results – Quadrat sampling

Data were recorded from 97 ¼ M^2 quadrats within the impact area (Figure 3). Fifty-two live mussels representing 8 species were collected. *Truncilla truncata* (deertoe) was the most abundant species found in quadrat samples within the impact area (Table 3). A single specimen of the state Threatened elktoe mussel was collected during this sampling. Density in live mussels/M^2 is estimated by dividing the number of live mussels by the number of samples and dividing the result by the fraction of a square meter sampled (¼ $M^{2)}$. In this case (52 live mussels/97 samples)/(1/4 M^2/sample) = 2.14 live mussels/M^2. Using the estimated area of the sampled river reach the mussel population can be estimated by multiplying the density by the area; in the impact area (2.14 live mussels/M^2)(33,330 M^2 impact area) = 71,470 live mussels/impact area (Table 4).

Impact Area

Species	Number Found Live
Deertoe	
Truncilla truncata	27
Plain Pocketbook	
Lampsilis cardium	9
Threeridge	
Amblema plicata	7
Fragile Papershell	
Leptodea fragilis	2
Wabash Pigtoe	
Fusconaia flava	2
Creeper	
Strophitus undulatus	2
Fat Mucket	
Lampsilis siliquoidea	2
Elktoe (Threatened)	
Alasmidonta marginata	1
Grand Total	**52**

Table 3. Species abundance from quadrat results in impact area.

Impact Area		Population Estimate
Mean(no/m^2)	2.103093	70,096.1
SD	3.790021	
SE	0.384818	
95%UCL (Upper Confidence Limit)	2.857337	95,235.0
95%LCL (Lower Confidence Limit)	1.348849	44,957.1

Table 4. Population estimate for Impact Area.

Data were recorded from 141 ¼ M^2 quadrats within the reference area (Figure 3). Forty one live mussels were found representing 8 species including the state species of Special Concern black sandshell. Relative abundance of mussel species collected in the reference area differed from the impact area in that *Lampsilis cardium* (pocketbook) was the most abundant species. (Table 4).

Density of live mussels was (41 live mussels/141 samples)/(1/4 M^2/sample) = 1.16/M^2 From the mussel density and estimated size of the reference area, the number of live mussels occupying the reference area is (1.16 live mussels/M^2)(34,030 M^2 impact area) = 39,581 live mussels (Table 5).

Reference Collection Area

Species	Number Found Live
Plain Pocketbook	
Lampsilis cardium	16
Threeridge	
Amblema plicata	9
Deertoe	
Truncilla truncata	7
Black Sandshell (Special Concern)	
Ligumia recta	3
Wabash Pigtoe	
Fusconaia flava	2
Fat Mucket	
Lampsilis siliquoidea	2
Pink Heelsplitter	
Potamilus alatus	1
Fragile Papershell	
Leptodea fragilis	1
Grand Total	**41**

Table 5. Quadrat results from Reference area.

Reference Area	Density	Population Estimate
Mean(no/m^2)	1.163120567	39,580.99291
SD	1.943355938	
SE	0.163660094	
95%UCL (Upper Confidence Limit)	1.483894351	50,496.92476
95%LCL (Lower Confidence Limit)	0.842346784	28,665.06105

Table 6. Population estimate for Reference Area

Twelve species of live mussels were collected by all sampling methods during these surveys and a single species was collected only as a weathered dead shell at a single site, *Anodontoides ferussacianus* (cylinder mussel), a species typically found in headwaters creeks.

Populations of the three most abundant mussel species (deertoe, pocketbook and threeridge) varied in age distribution by area (Figure 7). Most notably there was considerable evidence for ongoing recruitment of deertoe in the impact area but very little in the reference area and no evidence for recent recruitment of threeridge in the impact area.

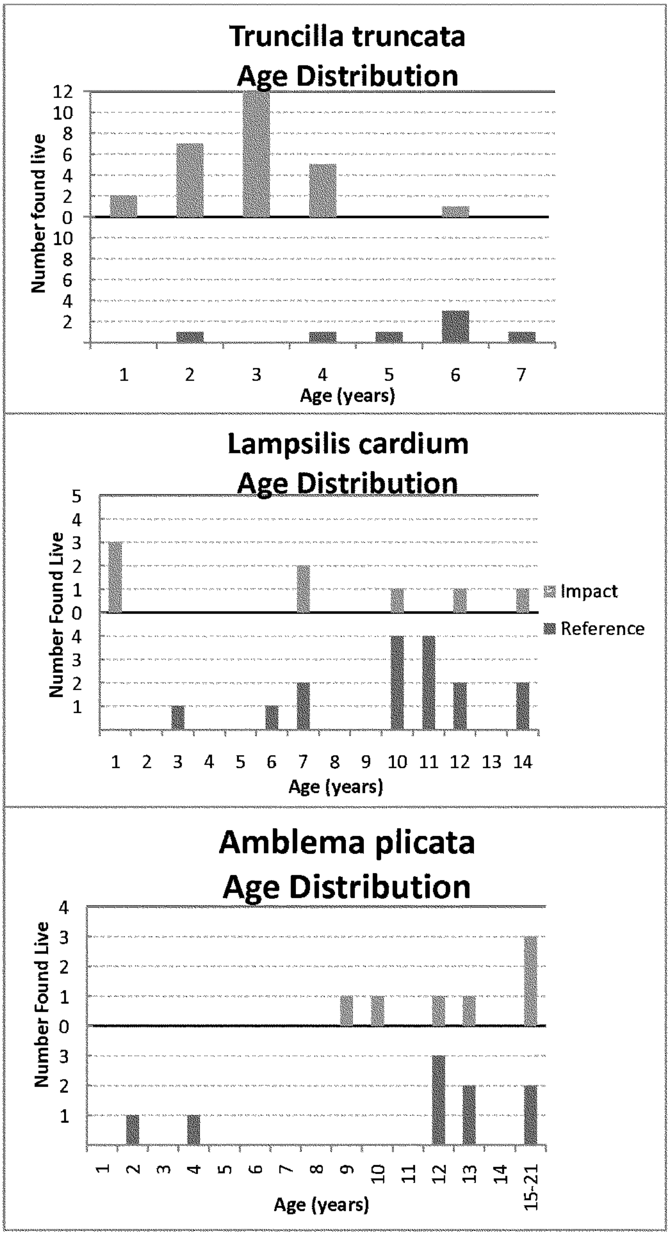

Figure 7. Age distribution of the three most abundant mussel species in the lower Pomme de Terre River from quadrat data.

Discussion

Physical habitat within the two areas differed in that the impact area appeared to be more stable as the river neared Marsh Lake and the river's delta. Stability and the predominance of firm sandy substrate (Figure 6) may favor the establishment of mussel populations. In the reference area the channel appeared to be quite unstable, with actively eroding outside bends, and had recently abandoned some channel segments while forming new channels though the floodplain forest. Many trees were in the process of being washed into the river often making it difficult to traverse. Substrate in the reference area appeared to be unstable and freshly deposited, even gravel and cobble deposits were soft and easily penetrated when traversed on foot. Quantitative data on the hydrogeomorphic characteristics of these two areas were not available for comparison at the time of this report.

Mussels were considerably more abundant in the impact area than in the reference area (density of 2.12 vs. 1.16). Relative abundance of the top three species collected during surveys also differed with deertoe mussels the most abundant in the impact area and pocketbook mussels most abundant in the reference area (Figure 5). It is likely that the estimated 70,000 mussels in the impact area will be adversely affected by the channel rerouting that will cut off Pomme de Terre River flows. These affects will depend on the final restoration plan but could result in the loss of most or all of the existing mussel population in the cutoff channels. Options for mitigating the loss of existing mussels could range from no action and accepting loss to translocation of some mussels, or provision of a minimum flow into the cutoff channels through the cutoff dikes. It is hypothesized that the reconnected former river channel will be colonized by mussels recruited from upstream and from the Minnesota River below the Marsh Lake Dam, replacing any loss of mussels from the impact area over time.

Future surveys within the impact area will document any changes that occur in the existing mussel population. Reference area sampling in the future will serve as an index to changes in the mussels that may be unrelated to this project. Sampling within the reconnected channel will be done in years following project completion and accomplished using comparable methods to determine the rate of mussel recolonization.

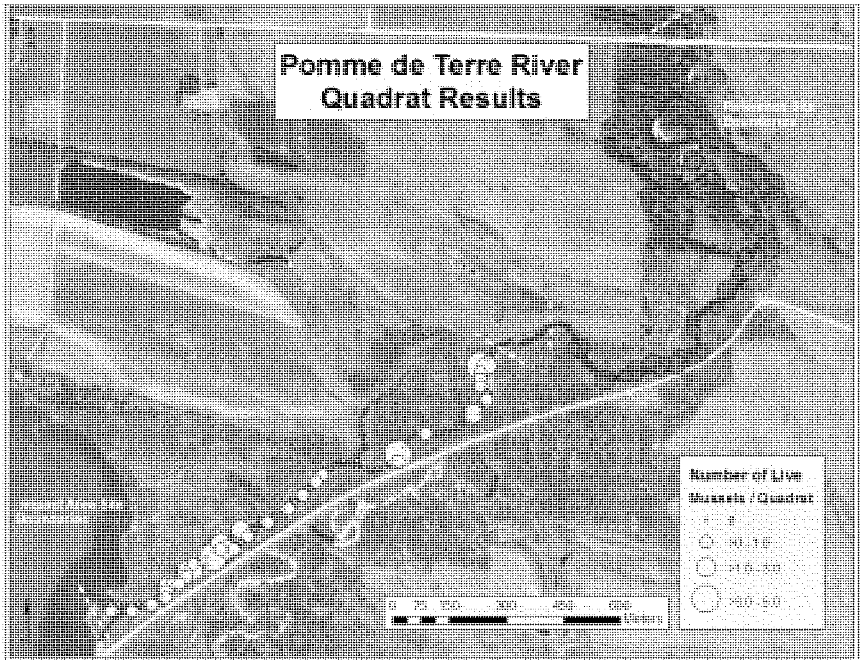

Figure 5. Abundance of live mussels collected in quadrat sample s in the impact and reference areas.

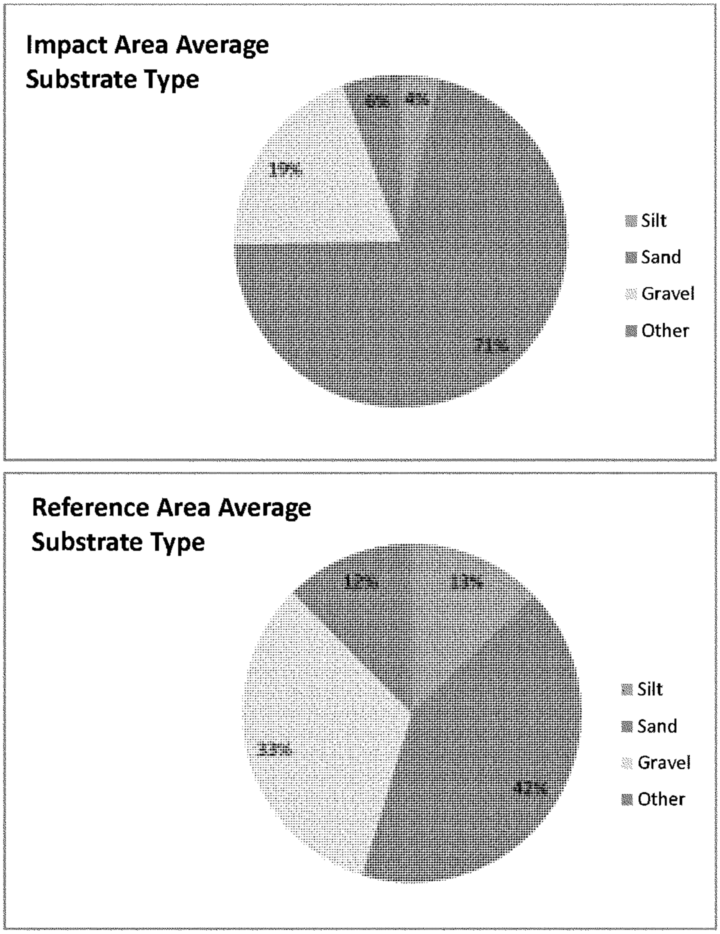

Figure 6. Distribution of substrate types estimated at quadrat sites.

References: Cochran W.G. 1977. *Sampling Techniques. Wiley series in probability and mathematical statistics-applied. John Wiley and Sons. New York.*

Appendix R – Adaptive Management and Monitoring Plan

Appendix R

Monitoring and Adaptive Management

Marsh Lake Ecosystem Restoration Project

Minnesota River

Big Stone, Lac qui Parle, and Swift Counties, Minnesota

April 2011

Introduction

Adaptive management (AM) is a structured process of learning by doing and adapting based on what's learned. AM is a process that promotes flexible decision making and implementation that can be adapted as outcomes from management actions become better understood. Careful monitoring of outcomes advances scientific understanding and helps adjust policies or operations as part of an iterative learning process.

Section 2039 of WRDA 2007 directs the Secretary of the Army to ensure that when conducting a feasibility study for ecosystem restoration that the recommended project includes a plan for monitoring the success of the ecosystem restoration. The monitoring plan shall include a description of the monitoring activities, the criteria for success, and the estimated cost and duration of the monitoring as well as specify that monitoring will continue until such time as the Secretary determines that the success criteria have been met. Within a period of ten years from completion of construction of an ecosystem restoration project, monitoring shall be a cost-shared project cost. Any additional monitoring required beyond ten years will be a non-Federal responsibility.

Monitoring and Evaluation of the Response of Native Mussels to Pomme de Terre River Restoration

The native mussel community in the Pomme de Terre River is described in Section 2.8.7 of the main report. The alternative measure to restore the Pomme de Terre River to its former channel is described in Section 4.1.4.

The lower Pomme de Terre River supports an abundant and diverse mussel community with two state-listed threatened and endangered species. Mussels in the lower reach of the channelized Pomme de Terre River below the lower cut-off embankent would no longer be in a flowing river and would probably die. Mussels in the river channel in the footprint of the cut-off embankment would be buried. Mussels are expected to recolonize the restored historic channel of the Pomme de Terre River after the fine-grained sediment that has been deposited there is washed out. Uncertainty exists about the recolonization of native mussels in the restored Pomme de Terre River channel.

Restoring the native mussel community in the historic channel of the Pomme de Terre River is not one of the project objectives and there have been no performance criteria set to evaluate ecological success. There are no Federally-listed endangered or threatened species in the Pomme de Terre River. A mussel relocation effort prior to construction is not in the Federal interest. The Minnesota Department of Natural Resources (DNR) may choose to relocate mussels from the impact area to other parts of the Pomme de Terre River.

Based on discussions with the DNR, restoring the Pomme de Terre River to its former channel includes pre-project monitoring to quantitatively characterize the mussel community and to estimate impacts of construction. Post construction monitoring would include a series of mussel and habitat surveys in the restored river channel.

Pre-Project Monitoring

A reference reach of the Pomme de Terre River upstream of the impact area was surveyed for mussels in 2010 (Appendix Q). A systematic survey of the impact area of the lower Pomme de Terre River was done in 2010 by collecting 0.25 m2 randomly located quadrat samples (Appendix Q). Additional sites not sampled in the 2007 survey were sampled by qualitative timed searches to better assess the species richness of the mussel community. From these data a population estimate, population demographics and community composition descriptors were generated and will be used as perspective when characterizing the recruitment of mussels into the restored channel over time. A map of the river showing the density of mussels, number of mussels <3 years old, and number of species found at each collection site was generated (Appendix Q).

A cursory survey of several sites within the old channel consisting of wading and snorkeling where needed will be done prior to construction to support or refute the assumption that there are no live mussels currently in the former Pomme de Terre River channel to be restored. The former Pomme de Terre River channel to be restored has had six or more inches of silt deposited there since the river was diverted when the Marsh Lake Dam was built. Mussels are unlikely to occur there now.

Post-Construction Monitoring

Following three years of flow through the restored channel areas above and below the Marsh Lake Dam, the DNR will survey the restored river channel using qualitative timed searches at a minimum of 5 sites to assist in finding all species present and systematic quantitative sampling similar to that used within the impact area. This monitoring will be done three times at three year intervals. At least 100 0.25 m2 quadrat samples will be collected to allow for a population estimate of mussels that may have been recruited since restoration of flows. Mussels collected during this sampling will be identified to species, measured (TL) and growth arrest lines counted. Qualitative information on the substrate types represented at each sample will be estimated and recorded as a percent among 7 substrate categories: Woody debris, Organic Detritus, Silt, Sand, Gravel, Cobble, or Boulder. A map of the river showing the density of mussels, number of mussels <3years old, and number of species found at each collection site will be generated.

The pre-project monitoring of the existing mussel community and post-construction monitoring to assess reestablishment in restored channel, their habitat, and the ecosystem services they provide is an important part of this project to the DNR. Approaches to accomplish that include: organism identification, enumeration, and valuation using American Fisheries Society (AFS) replacement numbers; habitat mapping and valuation, and ecosystem service identification and valuation. The DNR will conduct the monitoring work, reporting and evaluation. A more complete experimental design will be developed in the detailed design phase of the project.

A comparison of the density, species composition and age structure of the native mussels in the restored channel to the pre-project mussel community in the Pomme de Terre River will allow assessment of the ecological success of mussels in recolonizing the restored channel. There are no performance criteria for mussels that would indicate a need to modify the project. This AM activity will provide increased understanding of the ecological effects of river restoration on native mussels.

Estimated cost for the lower Pomme de Terre pre-project survey and three years of post-project monitoring was provided by the DNR (main report Table 4-2). The estimated total cost of $128,000 includes data analysis and reporting.

Table 4-2 (from main report). Estimated cost of Pomme de Terre River survey and monitoring mussel recolonization in the restored Pomme de Terre River channel.

Tasks	Days	# Crews	Per Day/one crew	Report	Total
Est. Current Channel Pop & Reference site	6	2	$ 2,000.00	$ 2,000.00	$ 26,000.00
Evaluate New Channel	1	2	$ 2,000.00	$ 2,000.00	$ 6,000.00
Cutoff Channel Mussel Salvage	2	2	$ 2,000.00	$ 1,000.00	$ 9,000.00
Yr3 Monit; New Channel/Reference site	6	2	$ 2,000.00	$ 5,000.00	$ 29,000.00
Yr6 Monit; New Channel/Reference site	6	2	$ 2,000.00	$ 5,000.00	$ 29,000.00
Yr10 Monit; New Channel/Reference site	6	2	$ 2,000.00	$ 5,000.00	$ 29,000.00
				Total	$ 128,000.00

Project Objectives and Performance Criteria to Evaluate Success in Ecosystem Restoration

Performance criteria for each of the project objectives have been identified (Table 1). Performance criteria are SMART; Specific, Measurable, Achievable, Relevant, and Time-bound. The performance criteria set by the PDT include target values and ranges where appropriate, considering inter-annual variation, future management actions and natural disturbance regimes.

Table 1. Ecosystem objectives and performance criteria for the Marsh Lake Project.

Marsh Lake Project Ecosystem Objectives	Performance Criteria
1. Reduced sediment loading into Marsh Lake	Pomme de Terre River re-routed into Lac qui Parle.
2. Restored natural fluctuations to hydrologic regime in Marsh Lake	Maintain water levels in Marsh Lake at 938.3 feet or higher 70% of the time in August, and 937.6 feet or higher 70% of the time in September and October, excluding years in which a draw down is completed.
	Low growing season water levels as needed to restore aquatic vegetation.
	Low winter water levels (following growing season drawdowns) to reduce carp abundance in Marsh Lake.
3. Restored natural geomorphic and floodplain processes in Pomme de Terre River	Delta area of the lower Pomme de Terre River with more natural hydrologic regime, distributary complexity, rates of change and vegetation communities by 2015.
4. Reduced sediment resuspension in Marsh Lake	Growing season average Secchi disc water transparency equal or greater than 0.5 m by 2020.
5. Increased extent, diversity and abundance of emergent and submersed aquatic plants in Marsh Lake	Increase the area of EAV in Marsh Lake to 1500 acres by 2015 with 200 acres of EAV other than cattail (e.g., bulrush, arrowhead)
6. Increased availability of waterfowl habitat within Marsh Lake	Increase the area of SAV in Marsh Lake to 2000 acres in 6 out of 10 years by 2020 with 400 acres of submersed plants other than Sago pondweed (e.g., coontail, milfoil). Detect SAV at 2/3 of sampled sites in Marsh Lake where water depth is less than 3 ft.
	Increase fall waterfowl use on Marsh Lake from 6,000 to 25,000 birds by 2015. As a subset, increase diving duck use from 400 to 5,000 birds by 2015 (measured by summarizing the peak count recorded for each species from weekly aerial surveys, mid-September through freeze-up, Marsh Lake. Survey area is from the Marsh Lake Dam to Louisburg Grade Road).
	Increase shorebird use on Marsh Lake from a current peak count now estimated in the hundreds to a peak count measured in the thousands by 2015. Criteria will only apply to those years of a natural or targeted growing season drawdown providing extensive mudflats.
	Maintain colonial waterbird numbers on Marsh Lake at approximately 19,000 American pelican and 1,000 double-crested cormorant nests, respectively (2006 & 2007 average). Maintain species diversity associated with nesting islands: ring-billed gulls, great egrets, great blue herons, black-crowned night herons, and Forster's terns. Breeding pairs of western grebes return to Marsh Lake by 2020.
7. Restored habitat connectivity for fish to migrate between Marsh Lake, the Pomme de Terre River and Lac Qui Parle	Increased natural reproduction of walleyes in the Pomme de Terre River by 2015 with naturally reproduced year classes 7 out of 10 years. Increase natural reproduction of northern pike by 2015 in Marsh Lake with naturally reproduced year classes in 3 out of 5 years.
8. Reduced abundance of carp in Marsh Lake	Modify fish community composition in Marsh Lake to less than 40 percent carp by weight by 2015.
9. Increased diversity and abundance of native fish in Marsh Lake and the Pomme de Terre River	Increased species richness and relative abundance (catch per unit effort by electrofishing) of native fish in the Pomme de Terre River by 2015.

Objectives and Monitoring Activities

Table 2 outlines the monitoring and evaluation activities and provides an estimated cost. For those activities that are routine and will be conducted regardless of the restoration project (e.g., Corps monitoring of water levels in Marsh Lake, DNR montoring fall waterfowl use), no additional costs would be incurred. The water quality monitoring work would be done by the Corps. The biological response (vegetation cover, fish, mussel monitoring) would be done by the DNR. The monitoring activities would be conducted in the first 10 years following project construction.

Table 2. Monitoring Activities and Estimated Cost.

Marsh Lake Project Ecosystem Objectives	Monitoring Activities	Estimated Cost
1. Reduced sediment loading into Marsh Lake	None	
2. Restored natural fluctuations to hydrologic regime in Marsh Lake	Water levels at Marsh Lake Dam	None - Monitored daily at dam
3. Restored natural geomorphic and floodplain processes in Pomme de Terre River	Vegetation cover in Pomme de Terre River delta, interpreted from aerial photography at years 1, 5 and 10	$10,000
4. Reduced sediment resuspension in Marsh Lake	Secchi transparency measurements measured weekly May through September	$5,000
5. Increased extent, diversity and abundance of emergent and submersed aquatic plants in Marsh Lake	Vegetation cover in Marsh Lake, interpreted from aerial photography in years 1, 5 and 10	(included in above)
6. Increased availability of waterfowl habitat within Marsh Lake	SAV rake survey in years 5, 10	$10,000
	Fall waterfowl surveys	None - Monitored annually by DNR
	Late summer shorebird surveys during drawdown years	$5,000
	Colonial waterbird colony surveys conducted annually	None - Monitored annually by DNR
7. Restored habitat connectivity for fish to migrate between Marsh Lake, the Pomme de Terre River and Lac Qui Parle	Fall fish surveys in Lac qui Parle conducted every other year	$10,000
8. Reduced abundance of carp in Marsh Lake	Fall fish surveys in Marsh Lake in years following drawdown	(included in above)
9. Increased diversity and abundance of native fish in Marsh Lake and the Pomme de Terre River	Stream electrofishing surveys in years 1, 5 and 10	$15,000
	Estimated Monitoring Cost over 10 years:	$55,000
	Evaluation and Reporting:	$15,000
	Total Monitoring and Evaluation:	$70,000

The total estimated cost for monitoring and evaluation of the Marsh Lake project to evaluate success in meeting the project objectives is $70,000 over 10 years following project construction. Monitoring to evaluate the response of native mussels to Pomme de Terre River restoration is estimated to cost $87,000 over 10 years following project construction. Pre-project monitoring work conducted in 2010 cost $26,000. Pre-project surveys and mussel relocation is estimated to cost $15,000.

7.2.3 Evaluation and Adaptive Management

Reports on condition of the Marsh Lake ecosystem with results of the monitoring activities will be prepared annually. Results of the monitoring activities will be used to evaluate ecosystem response to the project. Should the restoration and management actions not meet the performance criteria, the Corps and the DNR will evaluate adaptive management actions (management or project modifications) to best attain the ecosystem objectives for the project.

The tentatively recommended plan (Alternative Plan 4) includes measures to restore submersed aquatic vegetation (SAV) by reducing sediment loading, restoring the water level regime, and by reducing the abundance of carp (restore the Pomme de Terrre River to its former channel, modify Marsh Lake Dam with a fishway to attain target water levels, construct a water control structure in Marsh Lake Dam to enable drawdowns of the lake). Uncertainty exists about the response of SAV to these measures.

One alternative measure, constructing islands in Marsh Lake (included in Alternative Plan 5 in the feasibility report), is considered for implementation in the future if needed to attain the objectives submersed aquatic vegetation. Islands would reduce wind fetch and sediment resuspension, improving conditions for SAV growth. SAV aquatic vegetation and Secchi disc water transparency will be monitored to determine the success of the project in restoring SAV and to determine the need to construct islands.